Essays on Offshoring and on Determinants of NGO Survival

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Für

Jule und Jella

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1. GENERAL INTRODUCTION

1.1 Overview of this thesis

This thesis consists of three papers which are assigned to two parts. Part I focuses on the *for-profit sector*, analysing how offshoring affects the productivity of firms (chapter 2) and the labour market inequalities between differently skilled workers (chapter 3). Part II (chapter 4) focuses on the *non-profit sector*, analysing the determinants of the survival or exit of internationally active non-governmental organisations (NGOs). The two parts are largely independent from each other. Still, as I will illustrate in the research summary below, there are some analogies between the market for firms and the "market" for NGOs, on which we build in the second chapter. In the following I list the papers included in this thesis and provide some background context:

Part I: Offshoring

Chapter 2: Schwörer, Tillmann, "Offshoring, Domestic Outsourcing, and Productivity - Evidence for a Number of European Countries".

This chapter is based on a paper published in *Review of World Economics*, 2013, *149* (1), pp. 131–149, and includes a few additional results published in Kiel Working Paper 1786, Institute for the World Economy, 2012. My work on this paper was financially supported through the framework 7 project SERVICEGAP of the European Commission. The project aimed at assessing the impact of service innovation and internationalisation on growth and productivity. Thus, a particular focus of this paper is laid on the impact of service offshoring.

Chapter 3: Schwörer, Tillmann, "Offshoring and Labour Market Inequalities". This is an unpublished manuscript.

Part II: NGOs

Chapter 4: Nunnenkamp, Peter, Hannes Öhler, and Tillmann Schwörer, "US based NGOs in International Development: Financial and Economic Determinants of Survival".

This chapter is based on a paper published in *World Development*, 2013, *46*, pp. 45–65, and includes a few additional results published in "US based NGOs in International Development Cooperation: Survival of the Fittest?", Kiel Working Paper 1716, Institute for the World Economy, 2011. The work involved in this paper was distributed between my coauthors and me as follows. Peter Nunnenkamp provided the basic idea of applying methods well-known to the firm survival literature to a data set on internationally active NGOs, and he did most of the writing of the literature background. The empirical analysis and the writing of the empirical part was mainly done by Hannes Öhler and myself. The editing was roughly equally shared between the three of us.

1.2 Research summary

Part I: Offshoring

Offshoring, or the sourcing of inputs from abroad, is a salient feature of economic globalisation. Ongoing reductions in transportation and communication costs and reductions in politically set trade barriers allow firms to slice up their value chains into ever smaller fragments and to shift activities, which were previously done inhouse, abroad. Though offshoring is not a new phenomenon, recent developments in information and communication technologies have substantially widened the set of "offshorable" activities, in particular towards services.

In the public perception and the political debates, offshoring is a source of job destruction and of a race-to-the-bottom in wages and social standards. Many politicians in Europe feel tempted to shield their citizens from foreign low-wage competition through the imposition of minimum wages, though the effective power of such national policies is weak under free trade. By contrast, many economists have expressed more benign views on offshoring. Gregory Mankiw, in his role as chairman of the Council of Economic Advisers under US president George W. Bush, once famously stated that offshoring is "the latest manifestation of the gains from trade that economists have talked about at least

since Adam Smith" (Mankiw and Swagel, 2006). Part I of this thesis is motivated by the apparent gap in perceptions on offshoring and aims at bridging this gap. It analyses the consequences of offshoring in terms of efficiency and equity from the perspective of a developed European economy.

Chapter 2 sheds light on the efficiency aspect. It provides a detailed overview of the extent and the nature of offshoring and domestic outsourcing in the manufacturing sector of Western Europe since the mid-1990s, and traces the effects of offshoring and domestic outsourcing on firm productivity. The econometric analysis is based on combined industry-level data on offshoring and firm-level data on productivities, and builds on an econometric model similar to Amiti and Wei (2009). In addition, by allowing offshoring to interact with firm-level characteristics we identify heterogeneous effects of multinational firms vis-à-vis non-multinational firms, in the spirit of recent firm-level studies (e.g. Görg et al., 2008).

Beside the broad country coverage this study has two main contributions. First, this study is able to isolate the effects of offshoring from two confounding factors, which are domestic outsourcing and the replacement of domestic suppliers by foreign ones. Second, this study allows for heterogeneous effects for offshoring of core activities and non-core activities, where the latter group is further split into non-core material offshoring and service offshoring. We find positive productivity effects due to offshoring of non-core activities, but no significant effects due to offshoring of core activities and domestic outsourcing. The productivity effects of offshoring are driven in particular by offshoring to low-wage countries and by the gains of multinational firms.

Chapter 3 sheds light on the equity aspect. It provides evidence on changes in the relative demand for high, medium, and low skilled workers in the manufacturing and service sector of Germany since the mid-1990s, and assesses the explanatory power of offshoring. In the econometric analysis we use industry-level data and estimate systems of wage bill share equations, following Berman et al. (1994). The empirical model incorporates our insights on the measurement of offshoring and domestic outsourcing from chapter 2 and accounts for different types of offshored inputs (materials and services) and different offshoring destinations (e.g. Central and Eastern Europe, and China).

The paper extends the existing empirical evidence in two main directions. First, our empirical model allows for heterogeneous effects in the manufacturing sector and the service sector. Thus, we can test the hypothesis that low skilled workers in the service sector are less exposed to offshoring than in the manufacturing sector (Blinder, 2006, 2009), and

the hypothesis that offshoring and technological change in the service sector lead to polarisation in labour demand in disfavour of medium-skilled labour (Acemoglu and Autor, 2011). Second, we analyse whether offshoring affects labour market inequalities through changes in relative wages or through changes in relative employment, thus indirectly shedding light on the rigidity of wage structures and the role of labour market institutions in Germany.

The paper confirms previous evidence that offshoring is on average biased in favour of high skilled and in disfavour of low skilled workers, an effect that is primarily driven by the manufacturing sector, by material offshoring, and by offshoring to Central and Eastern Europe. Notably, we find that the direction of bias is converse in the service sector, in line with the Blinder (2006, 2009) hypothesis. Contrary to widely held believes we find that the labour market adjusts to offshoring mainly through changes in relative wages and less so through changes in relative employment. This result contradicts the perception that German labour market institutions prevent relative wages to adjust and, thus, cause unemployment among low skilled workers.

Finally, we may try to learn something from the combination of the findings in chapters 2 and 3: Recent theoretical work by Grossman and Rossi-Hansberg (2008) shows that the partial equilibrium effects of offshoring on productivity and on the demand for low skilled workers may interact *in general equilibrium* in such a way that low skilled workers are in the end better off. Following the main argument of their model, there is a positive feedback effect on the demand for low skilled workers because the low-skill intensive sector achieves greater productivity gains than the high-skill intensive sector and, thus, is able to expand. Hence, in Grossman and Rossi-Hansberg (2008) the overall wage effects for low skilled workers may be even positive.

It is beyond the scope of this thesis to test this econometrically, because the two chapters of part I feature partial equilibrium settings. Still, we can derive some insights on this aspect from descriptive evidence (see also section 3.2.2). We observe that the manufacturing sector, which is more engaged in offshoring than the service sector, is characterised by high shares of high skilled workers. Hence, if offshoring induces productivity gains and an expansion of the manufacturing sector, this further increases rather than decreases the aggregate relative demand for high skilled workers. This suggests that the feedback effect on the demand for low skilled workers may be, in fact, negative.

From the results we derive the following policy recommendations: First, to dampen the vivid critics to globalization and in particular offshoring, policy makers should try to bet-

ter explain the trade-off between efficiency and equity arising from offshoring, and they may consider stronger redistributive policies which could be financed through achieved efficiency gains. Second, the results for the service sector suggest that offshoring has complex effects on labour demand, which partly relate to the nature of work rather than to skills. Policy makers should foster research on the long-term changes of the global division of labour and the nature of work, and they should align the educational system in such a way that citizens are up to this future.

Part II: NGOs

Non-governmental organisations (NGOs) play a major role in international development assistance of the United States, accounting for about 40% of total foreign aid funds (McCleary and Barro, 2008). Foreign aid by NGOs is often regarded as superior to state aid, because NGOs are thought to be more efficient and better informed about local needs (Hulme and Michael, 1997). NGOs widely receive high levels of public trust because of the altruistic motives underlying their work and because NGOs do not distribute profits to their owners ("non-distribution constraint").

However, the "market" in which NGOs operate is inherently characterised by a particular type of market failure. Different from goods markets, the donors of foreign aid receive no products and, thus, cannot directly assess the impact of their donations. Also, donors are likely to make little efforts on ex-post evaluations once they have received utility from the act of giving ("warm glow"). As a consequence of these information asymmetries and difficulties in monitoring, NGO staff may feel invited to divert part of the funds away from aid projects to headquarter facilities, travel, or other perks. In fact, previous research has shown that there is a large heterogeneity between NGOs in terms of resource use. According to Nunnenkamp and Öhler (2012) the expenses for administration and management of a sample of US NGOs ranges from zero to about half of their budgets. This invites the question whether or not inefficient NGOs are sanctioned by donors and forced to exit the market.

Part II (chapter 4) takes up the role of market failures in the market of internationally active NGOs, by analysing the economic and financial determinants of NGO survival or exit. Our analysis is based on a data set of 900 NGOs in the period 1984 to 2005 and uses an empirical model which closely follows the literature on firm survival or exit (see e.g. Zingales, 1998; Görg and Spaliara, in press). In particular, we estimate probit

models to assess whether NGOs with high administrative and fundraising costs are more likely to discontinue their international development activities than more efficient peers. Furthermore, we assess whether the link between cost efficiency and survival/exit depends on the funding structure, thus indirectly shedding light on the monitoring and sanctioning behaviour of private and official donors. To our knowledge, this study is the first to provide an empirical assessment of the links between the efficiency, official funding and the survival of NGOs in international development.

We find evidence that an increase in administrative inefficiency is associated with an increase in the exit probability. Notably, this effect only applies for NGOs receiving official funding, which suggests that official bodies perform stricter monitoring of NGOs compared to private donors. Yet, we also find that the link between inefficiency and exit disappears at high levels of official funding. We conjecture that this may be due to a "too big to fail" policy, or due to the fact that these NGOs face softer budget constraints because they are independent of private donations.

An inherent difficulty in the evaluation of NGO performance is that the *quality* of foreign aid programmes is difficult to measure and widely unobserved. By contrast, the analysis in this chapter is based on measurable and objective, though rather narrow, aspects of efficiency. We advise against making administrative cost efficiency the *only* criteria for NGO evaluations, since the relationship between administrative costs and program impact is likely to be non-linear. Still, we believe that our analysis captures some important aspects and allows for some concrete suggestions: Our findings suggest that monitoring and sanctioning of NGOs should be improved to ensure the "survival of the fittest". Arguably, the predominance of private donations in the US casts doubt on the effective monitoring of NGOs. Also, the monitoring of NGOs through official bodies, in particular of large NGOs with high levels of public funding, should be improved. Moreover, NGOs should foster the formation of accountability clubs with self-imposed efficiency and quality standards to reduce information asymmetries and to signal quality and reliability to potential donors.

1.3 Bibliography

Acemoglu, Daron and David H. Autor, "Skills, Tasks and Technologies: Implications for Employment and Earnings," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, Vol. 4, Elsevier, 2011, chapter 12, pp. 1043–1171.

Amiti, Mary and Shang-Jin Wei, "Service Offshoring and Productivity: Evidence from the US," *World Economy*, 2009, *32* (2), 203–220.

Berman, Eli, John Bound, and Zvi Griliches, "Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufacturers," *The Quarterly Journal of Economics*, 1994, *109* (2), 367–397.

Blinder, Alan S., "Offshoring: The Next Industrial Revolution?," *Foreign Affairs*, 2006, *85* (2), 113–128.

_ , "How Many US Jobs Might Be Offshorable?," *World Economics*, April 2009, *10* (2), 41–78.

Görg, Holger and Marina-Eliza Spaliara, "Financial Health, Exports, and Firm Survival: Evidence from UK and French Firms," *Economica*, in press.

_ **, Aoife Hanley, and Eric Strobl**, "Productivity Effects of International Outsourcing: Evidence from Plant-Level Data," *Canadian Journal of Economics*, 2008, *41* (2), 670–688.

Grossman, Gene M. and Esteban Rossi-Hansberg, "Trading Tasks: A Simple Theory of Offshoring," *American Economic Review*, 2008, *98* (5), 1978–97.

Hulme, David and Edwards Michael, "NGOs, States and Donors: An Overview," in David Hulme and Michael Edwards, eds., *NGOs, States and Donors: Too Close for Comfort?*, Basingstoke: Macmillan Press, 1997, pp. 3–22.

Mankiw, Gregory N. and Phillip Swagel, "The Politics and Economics of Offshore Outsourcing," *Journal of Monetary Economics*, 2006, *53* (5), 1027–1056.

McCleary, Rachel M. and Robert J. Barro, "Private Voluntary Organizations Engaged In International Assistance, 1939-2004," *Nonprofit and Voluntary Sector Quarterly Journal*, 2008, *37* (3), 512–536.

Nunnenkamp, Peter and Hannes Öhler, "Funding, Competition and the Efficiency of NGOs: An Empirical Analysis of Non-Charitable Expenditure of US NGOs Engaged in Foreign Aid," *Kyklos*, 2012, *65* (1), 81–110.

Zingales, Luigi, "Survival of the Fittest or the Fattest? Exit and Financing in the Trucking Industry," *Journal of Finance*, 1998, *53* (3), 905–938.

Part I

OFFSHORING

2. OFFSHORING, DOMESTIC OUTSOURCING, AND PRODUCTIVITY - EVIDENCE FOR A NUMBER OF EUROPEAN COUNTRIES

2.1 Introduction

Offshoring, or the sourcing of inputs from abroad, is one of the most debated features of economic globalisation. Firms split up their value chains and relocate those activities which they perform with less efficiency to foreign affiliates or to external foreign suppliers. Numerous studies have documented the rapid growth in offshoring over the last decades (see e.g. Hummels et al., 2001; Amiti and Wei, 2005). While offshoring has for a long time been limited to material inputs, the last decade has also witnessed an increase in offshoring of services, a trend that has been triggered by the revolution in information and communication technologies (Blinder, 2006).

In the public perception offshoring is often associated with layoffs, wage reductions, and a rise in wage inequality. These fears have even led Germany to elect outsourcing in 1996 as "faux-pas word of the year". Indeed, there is evidence of at least some adverse labour market effects. In particular, offshoring is blamed to penalise low skilled workers since their jobs often involve routine activities which are more easily offshorable than the activities of high skilled workers (Feenstra and Hanson, 1996; Geishecker and Görg, 2008). Blinder (2006, 2009) has caused alarm with estimates of about 25% of American jobs that are potentially exposed to offshoring.

In light of the anxiety about job losses and wage reductions, research has been mostly focused on the labour market effects of offshoring, while there is only a small literature on the productivity effects of offshoring. This study argues that the importance of this aspect has been overlooked. First, productivity is an important driver of economic growth and hence interesting in its own right. Second, recent theoretical studies show that there are

positive feedback effects on the labour markets provided that offshoring raises productivity. According to Grossman and Rossi-Hansberg (2008) the wages of unskilled workers may rise despite their vulnerability to offshoring if the productivity effect induced by offshoring is sufficiently large; Mitra and Ranjan (2010) show that due to the presence of productivity effects offshoring may decrease unemployment and increase wages; Kohler and Wrona (2010) identify conditions under which job creation dominates job destruction in the presence of productivity effects. Hence, analysing the offshoring-productivity link is important to better understand feedback effects on the labour markets.

The existing literature on this topic provides some evidence that offshoring can increase productivity, but the identified effects are quite heterogeneous depending on the analysed country, the type of firms (e.g. exporters versus non-exporters) or the type of offshored inputs (materials or services):[1] Görg and Hanley (2005) find that material offshoring has contributed to an increase in the productivity of firms with low export intensities in the Irish electronics sector. Egger and Egger (2006) find that offshoring lowers the productivity of low skilled workers in the short run, but raises their productivity in the long run. Görg et al. (2008) find that service offshoring enhances the productivity of exporting firms in the Irish manufacturing sector. Hijzen et al. (2010) show for Japanese firms that offshoring to foreign affiliates raises productivity, while offshoring to external suppliers has no such effect. Amiti and Wei (2009) find that offshoring increases productivity, with service offshoring accounting for 10% and material offshoring accounting for 5% of the productivity growth in the United States. Winkler (2010) finds that service offshoring increases the productivity of German manufacturing industries, when controlling for domestic outsourcing. Wagner (2011) finds some evidence for positive productivity effects for German firms using a matching approach.

A criticism which applies for most studies in this literature is that the interpretation of the central offshoring measure is ambiguous. Offshoring is widely defined as the share of imported inputs in total inputs and is measured at the industry level through a combination of input-output tables and import data (Feenstra and Hanson, 1996). The offshoring measure per se does not allow distinguishing whether internal production is moved out to foreign suppliers (offshoring) or to domestic suppliers (domestic outsourcing), or whether domestic suppliers are replaced by foreign suppliers (supplier change). See Castellani et al. (2013) for a detailed analysis of this problem.

The present study provides stylized facts on offshoring in Europe between 1995 and 2008

[1] See Olsen (2006) for an early survey of the offshoring-productivity literature.

taking into account this distinction. This study shows that many services which were previously provided internally have systematically been offshored and outsourced domestically. For material inputs, by contrast, there is also evidence of systematic replacements of domestic by foreign suppliers. Overall the share of internal production has gone down by 4.5 percentage points, which raises the question whether firms have achieved productivity gains through this specialisation effort. This question is addressed by combining industry data on offshoring and domestic outsourcing with a firm panel. Using fixed effects regressions and an instrumental variable approach I find that offshoring of non-core activities has led to productivity gains, whereas offshoring of core activities and domestic outsourcing have had no such effects. The estimated productivity gains are in particular driven by offshoring to low-wage countries and by the gains of multinational firms.

The remainder of this study is structured as follows. Section 2.2 discusses possible channels for productivity effects, section 2.3 illustrates how offshoring is measured and provides stylized facts on offshoring in Europe, section 2.4 describes the empirical model, section 2.5 presents the regression results, and section 2.6 concludes.

2.2 Channels for productivity effects

To motivate the analysis of productivity effects, different channels through which offshoring may affect productivity are discussed:[2] *First*, a static efficiency gain may arise when firms focus on their core competencies and offshore their less productive activities to foreign suppliers. Offshoring may therefore be all the more beneficial the less productive the activity is done internally. For instance, one may expect that offshoring of business services by a manufacturer bears a greater potential for productivity gains than offshoring of its core production activities. *Second*, offshoring may also come along with restructuring measures which reduce inefficiencies. For instance, offshoring may induce firms to reorganize the way in which tasks are bundled or to improve the communication and reporting system between departments. *Third*, offshoring firms may benefit from learning externalities which arise due to the interaction with foreign suppliers. For instance, workers may learn about new software packages or gain knowledge about technologies used by the foreign supplier. *Fourth*, offshoring may raise productivity if the imported input varieties are of higher quality or better match with the specific needs of the firm. *Fifth*, in Glass and Saggi (2001) offshoring to low-wage countries lowers the marginal production

[2] See Amiti and Wei (2009) for a similar summary of channels for productivity effects.

costs and raises profits, which creates resources for additional R&D investments. Thus, offshoring may indirectly raise productivities through an increase in innovation activities. Görg and Hanley (2010) provide empirical support for this hypothesis on the basis of Irish plant-level data. *Sixth*, offshoring may induce general equilibrium effects if realised productivity gains spill over to other firms or if offshoring induces tougher competition and selection effects in their markets.

Note that the relevance of individual productivity channels cannot be evaluated in this study. In particular, effects for offshoring firms cannot be isolated from general equilibrium effects on competitors or upstream and downstream firms, because offshoring is not observed at the firm level. Yet, this study can provide an indication of heterogeneous effects for different types of firms by combining the industry-level offshoring data with a firm panel.

2.3 Offshoring and domestic outsourcing

2.3.1 Measurement and data

In this paper offshoring is defined as the share of imported inputs in output, and domestic outsourcing is defined as the share of domestic inputs in output. More specific offshoring and domestic outsourcing variables are defined in the following based on inputs types and based on groups of supplier countries. All variables on offshoring and domestic outsourcing capture inputs from affiliates and from external suppliers, and are measured for an industry j in country c and year t. We can write:

$$\text{Offshoring}_{jct} = \frac{\sum_k (\text{Imported inputs from industry k by industry j})_{ct}}{(\text{Output of industry j})_{ct}} \tag{2.1}$$

$$\text{Domestic outsourcing}_{jct} = \frac{\sum_k (\text{Domestic inputs from industry k by industry j})_{ct}}{(\text{Output of industry j})_{ct}} \tag{2.2}$$

In a first step, three offshoring variables are distinguished by restricting the numerator of equation 2.1 to specific supplier industries k. Offshoring of core activities captures inputs from the buyer's own industry ($k = j$). Offshoring of non-core activities captures inputs from all manufacturing industries except the buyer's industry ($k \neq j$, manufacturing). The two variables can be subsumed under the term material offshoring. Service offshoring captures inputs from six service industries, including post and telecommunication services, financial services, computer services, R&D, and other business services, as

in Amiti and Wei (2009) ($k \neq j$, services). In the same way, three domestic outsourcing variables (for core activities, non-core activities and services) are distinguished.[3]

Note that the material offshoring variables are equivalent to the well-known narrow offshoring measure (for core activities) and difference offshoring measure (for non-core activities) in Feenstra and Hanson (1999).[4] This study prefers the new terms, however, to better illuminate the economic content of these measures. In the literature the difference measure is widely treated as a residual that exists only with reference to the broad and narrow offshoring measure, and it is usually ignored in econometric analyses. Yet, this study argues that offshoring of non-core activities may have even larger productivity effects than offshoring of core activities, since the firms should generally be less productive in the former type of activities. In a second step, the offshoring variables are further distinguished according to the countries that are supplying the inputs to country c. The first group of supplier countries comprises Austria, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, and the United Kingdom. Note that these are precisely the countries which are analysed as receiving (or offshoring) countries in this study. The second group comprises 14 high-income OECD countries, not including the countries of the first group.[5] The third group comprises the rest of the world.

The data on offshoring are from the World Input Output Database (WIOD), which provides information on input-output relations between industries in 40 countries between 1995 and 2009.[6] Different from standard input-output tables, WIOD contains a breakdown of input-output relations by supplier country. That is, WIOD allows attributing where the inputs of a specific industry are sourced from. The denominators of the offshoring measures – industry output – can be directly taken from WIOD. The numerators can be calculated on the basis of WIOD by building the column sums over groups of supplier industries k and over groups of supplier countries. Note that the database has several unique features which help resolving measurement limitations that have been present in previous studies based on input-output tables:[7]

[3] Henceforth, this study refers only to offshoring, to keep the explanations brief. However, equivalent arguments apply for domestic outsourcing.

[4] The only difference is with respect to the denominator. In Feenstra and Hanson (1999) offshoring is scaled by non-energy inputs, while in this study offshoring is scaled by output.

[5] Australia, Belgium, Canada, the Czech Republic, Denmark, Estonia, Greece, Hungary, Ireland, Japan, the Republic of Korean, Luxembourg, the Slovak Republic, the United States.

[6] Downloadable at http://www.wiod.org/database/index.htm. See Timmer et al. (2012) for detailed information on the methods applied in the construction of the world input-output table. All information on WIOD presented in the following is taken from this background document.

[7] See Winkler and Milberg (2009), Castellani et al. (2013) and Feenstra and Jensen (2012) for detailed information on measurement problems in offshoring measures.

First, the world input-output table contains annual data on domestic inputs and on foreign inputs, which allows offshoring to be distinguished from domestic outsourcing and supplier changes. Castellani et al. (2013) show that standard offshoring measures fail to account for this distinction and as a consequence tend to overestimate the importance of business service offshoring. In the context of this study, however, this aspect is of particular relevance because it is likely the case that offshoring, domestic outsourcing and supplier changes have different effects on productivity. Second, the supply and use tables underlying the world input-output table are more frequently available than input-output tables from EUROSTAT or the OECD. For the nine European countries considered in this study the time coverage is almost complete (Timmer et al., 2012, p.69). This reduces considerably the measurement bias arising from the imputation of missing data.

A related issue is the choice of the variable in the denominator. The literature has used non-energy inputs (e.g. Feenstra and Hanson, 1999; Amiti and Wei, 2009), value added (Hijzen et al., 2005), or output (Geishecker and Görg, 2008). However, offshoring variables scaled with non-energy inputs or with value added are hard to interpret because both variables are affected by changes from internal production to domestic outsourcing (Geishecker, 2007). To resolve these ambiguities output is chosen as the denominator.

Third, the distinction between domestic and foreign inputs is achieved in WIOD through an imputation method which dispenses with the traditional type of proportionality assumption, which is present in standard input-output tables of imports. According to the proportionality assumption every industry imports a specific input in the same proportion as the whole economy. It is well-known that this assumption is quite restrictive (Winkler and Milberg, 2009; Feenstra and Jensen, 2012). WIOD is based on a weaker type of proportionality assumption which allows import shares to differ between the three use categories intermediates, final consumption and investment.

2.3.2 Patterns of offshoring and domestic outsourcing

The following part provides an overview of offshoring patterns in Europe's manufacturing industries between 1995 and 2008.[8] To account for differences in the size of industries all observations are generally weighted by industry output.

[8] For brevity, the nine considered European countries are henceforth often labeled as 'Europe'.

Tab. 2.1: Output composition - internal production, domestic outsourcing and offshoring

	1995	2008	Δ ppt
Internal production			
All activities	33.50	28.97	-4.53
Domestic outsourcing			
Core activities	11.23	10.08	-1.15
Non-core activities	10.92	9.62	-1.30
Services	7.36	7.96	0.60
Offshoring			
Core activities	6.41	8.94	2.53
Non-core activities	5.27	7.12	1.85
Services	0.64	1.07	0.43

Notes: This table shows the average output composition of manufacturing industries in 1995 and in 2008 (in %), and the corresponding changes (in percentage points). Output is composed of internal production, domestically outsourced inputs and offshored inputs. All observations are weighted by industry output. Sources: WIOD, own calculations.

Table 2.1 decomposes output into three components: internal production, domestic outsourcing and offshoring.[9] The table shows that in 2008 about 29% of the firms' output originates from internal production, 28% is due to domestically outsourced inputs and 17% is due to offshored inputs. Domestic outsourcing is further distinguished into core activities (10.0%), non-core activities (9.6%) and services (7.9%). Offshoring is distinguished into core activities (8.9%), non-core activities (7.1%) and services (1.1%). A first stylized fact is, thus, that material inputs are offshored and domestically outsourced to a similar degree, whereas services are predominantly outsourced domestically. This can be regarded as evidence that many services are not yet tradeable over longer distances. In particular, this may be due to services that require regular face-to-face contact with customers, or due to services that involve non-routine activities (Blinder, 2009).

Furthermore, table 2.1 shows that between 1995 and 2008 offshoring of core activities has increased by 2.5 percentage points (ppt) and offshoring of non-core activities has increased by 1.8 ppt. This increase in material offshoring has coincided with a decrease in internal production, which suggests that internal production of materials has been moved out to foreign suppliers (genuine offshoring).[10] Yet, this has also coincided with a decrease in the domestic outsourcing measure, which suggests that domestic suppliers have

[9] Note that the shares of these components in output would sum to 100% if inputs from the primary sector and some remaining service industries (e.g. transport services) were included in the offshoring measures and the domestic outsourcing measures.

[10] Note that the increase in service offshoring and domestic service outsourcing could be also due to newly created services. It is not possible to verify this possibility with input-output data as the composition of internal production (i.e. the share of internal services, core activities, and non-core activities) is unknown.

been partly replaced by foreign suppliers (supplier change). For services, the patterns are somewhat different. Service offshoring has increased by 0.4 ppt, domestic service outsourcing has increased by 0.6 ppt, and internal value added has decreased. This suggests that internal services have been moved out to domestic suppliers (genuine domestic outsourcing) and to foreign suppliers (genuine offshoring).

Tab. 2.2: Output composition by country

	Internal	Domestic outsourcing			Offshoring		
	All	Core	Non-core	Services	Core	Non-core	Services
Austria	-4.38	-1.78	-2.68	-0.35	5.97	2.21	-0.58
Germany	-6.19	-0.43	-2.90	-0.04	4.05	2.78	0.36
Spain	-3.93	-0.19	-0.33	0.37	1.67	1.01	0.79
Finland	-4.23	-2.05	-1.56	0.12	0.95	0.55	2.09
France	-3.85	-1.13	-0.15	1.58	1.89	1.81	0.22
United Kingdom	0.06	-4.17	-4.67	0.65	1.31	1.31	0.37
Italy	-3.48	-1.20	-1.53	1.59	1.17	0.67	0.29
Netherlands	-4.04	-0.55	-0.85	0.67	1.76	0.10	0.37
Sweden	-6.24	-2.35	-1.06	1.83	2.33	1.94	1.36

This table shows country-level changes (in percentage points) in the output composition of manufacturing industries between 1995 and 2008. Output is composed of internal production, domestically outsourced inputs and offshored inputs. All observations are weighted by industry output. Sources: WIOD, own calculations.

Table 2.2 shows country-level changes in the composition of output between 1995 and 2008, and table 2.3 shows the corresponding industry-level changes. The numbers are in percentage points. Overall, one observes that the general offshoring patterns identified above hold for most of the countries and industries individually. One of the few exceptions is the United Kingdom, where internal production has remained constant and domestic material outsourcing has fallen sharply. Here the rise in the material offshoring variables seems to be predominantly the result of supplier changes rather than genuine offshoring.

Table 2.4 makes a comparison of Europe and the United States. To make the two markets comparable in terms of economic size, the nine European countries are treated as a single market. This implies that domestic outsourcing comprises all inputs supplied by either of these European countries, and offshoring comprises all inputs supplied by countries outside this region. The table shows that the share of internal production has been similar for the two markets in 1995 (each about 33%), but has decreased considerably faster in Europe compared to the United States (-4.5 versus -1.2 ppt). The numbers suggest that internal services have been moved out in both markets to domestic suppliers and to foreign suppliers. However, with respect to material inputs, the numbers suggest that

Tab. 2.3: Output composition by industry

		Internal	Domestic sourcing			Offshoring		
		All	Core	Non-core	Services	Core	Non-core	Services
15-16	Food & tobacco	-1.39	-0.42	-0.33	2.03	0.84	0.68	0.44
17-18	Textiles & clothing	-3.23	-3.22	-0.84	1.98	-1.00	1.03	0.39
19	Leather	0.55	-2.37	-1.77	1.11	0.49	0.48	0.31
20	Wood	-3.81	-0.46	-0.50	-0.06	0.73	1.84	0.18
21-22	Paper & publishing	-3.06	-4.39	-0.55	1.58	-0.12	0.80	0.44
24	Chemicals	-5.35	-3.36	-1.28	0.64	3.72	1.43	0.51
25	Rubber, plastics	-4.96	-0.28	-4.21	0.84	1.03	3.19	0.37
26	Glass, ceramics	-6.20	0.94	-0.84	0.14	0.51	1.19	0.34
27-28	Metals	-5.27	-1.98	-1.08	-0.10	5.35	0.92	0.17
29	Machinery	-3.74	-0.34	-2.91	0.47	2.08	2.70	0.31
30-33	Electrical & medical	-2.48	-3.07	-1.51	0.80	1.71	2.20	1.03
34-35	Transport equipment	-7.45	1.55	-4.52	0.36	4.53	2.53	0.37
36-37	Manufacturing, nec	-2.88	1.05	-2.89	-0.26	0.38	2.17	0.20

This table shows industry-level changes (in percentage points) in the output composition of manufacturing industries between 1995 and 2008. Output is composed of internal production, domestically outsourced inputs and offshored inputs. All observations are weighted by industry output. Sources: WIOD, own calculations.

Tab. 2.4: United States and Europe

	United States			Europe		
	1995	2008	Δ ppt	1995	2008	Δ ppt
Internal production						
All activities	33.14	31.89	-1.25	33.50	28.97	-4.53
Domestic outsourcing						
Core activities	17.90	15.45	-2.45	14.92	14.39	-0.53
Non-core activities	16.47	13.94	-2.53	13.89	13.00	-0.89
Services	8.50	9.80	1.30	7.55	8.29	0.74
Offshoring						
Core activities	3.34	4.61	1.27	2.72	4.63	1.91
Non-core activities	2.92	4.20	1.28	2.30	3.74	1.44
Services	0.45	0.60	0.15	0.45	0.74	0.29

This table shows the average output composition of manufacturing industries in the United States and Europe in 1995 and 2008 (in %) and the corresponding changes (in percentage points). Europe is treated as a single market. Hence, domestic outsourcing comprises all inputs from European suppliers. All observations are weighted by industry output. Sources: WIOD, own calculations.

Europe has systematically moved out internal production to foreign suppliers whereas the United States have mainly realized supplier changes.

Tab. 2.5: Offshoring by supplier region

	Core activities		Non-core activities		Services	
	1995	2008	1995	2008	1995	2008
Europe	3.69	4.31	2.96	3.38	0.19	0.33
OECD countries (excl. Europe)	1.55	1.91	1.32	1.59	0.29	0.33
Rest of the world	1.17	2.72	0.99	2.15	0.16	0.41

This table shows average offshoring intensities (in %) in 1995 and 2008, by group of supplier countries. European countries are excluded from the group of OECD countries. Statistics are weighted by industry output. Sources: WIOD, own calculations.

Tab. 2.6: Share of supplier regions in total offshoring

	Core activities		Non-core activities		Services	
	1995	2008	1995	2008	1995	2008
Europe	57.06	47.15	56.55	48.43	31.13	32.65
OECD countries (excl. Europe)	22.83	19.70	24.87	21.76	48.86	32.39
Rest of the world	20.11	33.15	18.58	29.81	20.00	34.96
Sum	100.00	100.00	100.00	100.00	100.00	100.00

This table shows the share of single groups of supplier countries in total offshoring (in %) in 1995 and 2008. European countries are excluded from the group of high-income OECD countries. Statistics are weighted by industry output. Sources: WIOD, own calculations.

The tables 2.5 and 2.6 show offshoring trends in terms of supplier countries. Table 2.5 shows offshoring intensities for three groups of supplier countries: Europe, other high-income OECD countries and the rest of the world (ROW). Table 2.6 shows the relative share of each of these groups in total offshoring. A stylized fact is that material and service offshoring have increased for all three supplier regions. This suggests that offshoring costs must have generally fallen. Another stylized fact is that offshoring from ROW has gained relative importance. For instance, service offshoring from ROW represented one-fifth of total service offshoring in 1995 and already one third of total service offshoring in 2008. Since ROW comprises predominantly low-wage countries, this indicates that labour cost differentials may have been an important driver of firms' offshoring decisions. A final stylized fact is that the relative importance of Europe as a supplier of services differs considerably from its relative importance as a supplier of materials. Europe's share in total material offshoring has strongly decreased, whereas its share in total service offshoring has slightly increased.

To sum up, some key stylized facts are highlighted: (i) Offshoring has increased through-

out virtually all of the considered countries and industries in Europe, and it has increased with respect to different supplier regions. (ii) The observed increase in material offshoring reflects genuine offshoring as well as supplier changes. This increase has occurred for core activities and non-core activities. (iii) With respect to services, both genuine domestic outsourcing and genuine offshoring are observed, while there is no evidence of systematic supplier changes. (iv) The relative importance of domestic outsourcing vis-à-vis offshoring is considerably higher for services than for materials, suggesting that many services are still hard to be traded over longer distances. (v) Overall, the share of internal production has gone down by 4.5 ppt. This raises the question whether firms have managed to achieve productivity gains through this specialisation effort.

2.4 Empirical strategy

For the analysis of productivity effects offshoring data at the country-industry-level is combined with a firm panel spanning the period 1996 to 2008. In this setup an increase in offshoring captures an aggregate offshoring trend, which does not imply that all firms within a country-industry cell are involved in offshoring. Hence, the regressions capture average productivity effects comprising the effects for offshoring firms and the effects for their competitors. To capture some of the heterogeneity present within country-industry cells, additional firm-level variables are introduced and interacted with offshoring. In particular, it is estimated in this way whether there are different productivity effects for multinational and non-multinational firms.

2.4.1 TFP model

In the first step, Cobb-Douglas production functions are estimated:

$$VA_{it} = \alpha^j + \beta_K^j K_{it} + \beta_L^j L_{it} + TFP_{it} \tag{2.3}$$

where VA, K and L are the logarithms of value added, capital and labour, and where i and t are indices for firms and years. The parameters β_K and β_L are capital and labour intensities. To allow for differences in technologies across industries, the production functions are estimated separately for 98 three-digit manufacturing industries j. The residuals are

extracted and used in the following as the measure of total factor productivity (TFP). See table 2.11 in the appendix for the TFP regression results.[11]

The firm-level data comes from Amadeus, a commercial database provided by Bureau van Dijk. Amadeus contains information on the balance sheet, profit and loss account, industrial activity and ownership structure of more than two million firms in 41 European countries. The data are gathered by different national institutions and finally compiled and harmonised by Bureau van Dijk. Data is extracted for firms in the manufacturing sector in Austria, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden and the United Kingdom between 1996 and 2008. The NACE industries 23 and 37 are dropped due to insufficient observations. Money values for Sweden and the United Kingdom are converted into euros based on exchange rates from EUROSTAT. To account for price changes nominal values are deflated by industry-specific deflators from EU KLEMS and the STAN database. Labour and capital inputs are given by the number of employees and tangible fixed assets. The sample is restricted to firms with more than five employees, value added larger than 100,000 euros, and tangible capital larger than 5,000 euros. To avoid outlier problems, the 2% of the observations with the largest (absolute) residuals in the TFP regressions are dropped, and then the TFPs are re-estimated.

Tab. 2.7: Average performance by country

Country	L	K (th. €)	VA (th. €)	TFP	VA/L	Obs
Austria	356	21,439	28,145	9.7	82,751	573
Germany	414	16,935	39,059	9.8	68,359	26,674
Spain	57	2,707	2,862	9.0	41,262	205,811
Finland	68	4,633	4,833	9.5	55,475	26,179
France	128	4,416	8,813	9.6	58,051	110,152
United Kingdom	56	2,589	3,169	9.5	53,628	311,267
Italy	137	10,424	12,774	9.7	77,023	5,725
Netherlands	50	2,669	3,333	9.6	55,904	51,635
Sweden	301	18,348	22,213	9.6	64,961	29,687

This table shows the average performance of firms by country. Source: Amadeus, own calculations.

Note that the data set is not representative because reporting requirements vary across countries, as can be seen in table 2.7.[12] Spain and Italy are overrepresented in the data, and also the average firm characteristics such as the capital stock or the number of employees

[11] The TFP estimations were also conducted with the Levinsohn-Petrin method to account for a possible simultaneity bias. Yet, this caused partly implausible point estimates for some of the industries, such as negative coefficients for capital. For this reason the following analysis is based on simple ordinary least square (OLS) estimates of TFP.

[12] See table 2.12 in the appendix for a corresponding breakdown of the average firm performance by industry.

vary considerably across countries. These are certainly limitations of the data. Yet, the cross-country differences should play a minor role for the econometric analysis, as the fixed effects regressions use only the within-firm variation in TFP. Also, robustness checks are conducted for subsamples of firms, for instance by excluding Spain and Italy.

2.4.2 Offshoring model

In the second step the firm panel is combined at the industry-country-year level with the offshoring data and the following fixed effects model is estimated:

$$TFP_{it} = \alpha + \boldsymbol{\beta_O}\mathbf{Off_{jct}} + \boldsymbol{\beta_D}\mathbf{Dom_{jct}} + \gamma R\&D_{jct} + \mu_i + \mu_t + \varepsilon_{it} \tag{2.4}$$

Total factor productivity (*TFP*) is regressed on offshoring (**Off**) and domestic outsourcing (**Dom**), where offshoring and domestic outsourcing are captured through the corresponding variables for core activities, non-core activities, and services. The research and development intensity (*R&D*) is included as a control variable to account for the fact that technological change may be correlated with productivity and with offshoring. It is measured as share of R&D expenditures in output based on industry-country-level data from ANBERD. The variable μ_i denotes firm fixed effects that capture all time-invariant characteristics of the firm, including the time-invariant characteristics of the firm's industry (μ_j) and country (μ_c). The variable μ_t denotes year fixed effects that account for business cycles common for all countries and industries. The idiosyncratic error ε_{it} allows for clustering at the country-industry level. Correction for clustering is required since the offshoring variables are measured at a higher level of aggregation than the dependent variable (Moulton, 1990). The coefficient vectors $\boldsymbol{\beta_O}$ and $\boldsymbol{\beta_D}$ represent the marginal effects of offshoring and domestic outsourcing.

Note that the existing literature has widely used either an offshoring measure for core activities (narrow offshoring) or a measure for all manufacturing activities (broad offshoring) in similar regression models. By contrast, we jointly include offshoring variables for core and for non-core activities, to allow for different effects of the two types of activities. The productivity gains are expected to be higher for offshoring of non-core activities because this type of offshoring might free up resources in relatively unproductive activities.

In a third step, to capture some of the heterogeneity present within industry-country cells, an *MNE* dummy, which captures whether a firm is part of a multinational enterprise, is

included and interacted with offshoring. The empirical model then becomes:

$$TFP_{it} = \alpha + \boldsymbol{\beta_O}\mathbf{Off_{jct}} + \beta_M MNE_{it} + \boldsymbol{\beta_{MO}}\mathbf{MNE\_Off_{it}} + \boldsymbol{\beta_D}\mathbf{Dom_{jct}} + \gamma R\&D_{jct} + \mu_i + \mu_t + \varepsilon_{it} \tag{2.5}$$

Note some particular features of the multinationality dummy: *MNE* is one either if a firm owns one or more foreign subsidiaries or if the firm itself is owned by a foreign firm. Ownership is defined in terms of a benchmark of 50% of the firms' shares, and it includes direct as well as indirect ownership. Note further that the information on shareholders and subsidiaries is only observable for the most recent period in the data.[13] Therefore, it is assumed that the *MNE* status does not change over time, which implies for the fixed effects regressions that the main effect of multinationality β_M is fully cancelled out by the firm fixed effects (μ_i). The interaction effects between multinationality and offshoring, which are of primary interest in this context, are not affected, though. The coefficient vector $\boldsymbol{\beta_{MO}}$ thus captures additional productivity effects for multinational firms vis-à-vis non-multinationals.

Possible endogeneity problems are addressed in the following way: First, this study reduces the potential for omitted variable bias by controlling for domestic outsourcing. In this way the study avoids confounding offshoring with domestic outsourcing or with supplier changes.[14] This is important because genuine offshoring may be expected to have the largest productivity impact. Most of the existing offshoring literature working with input-output data does not control for domestic outsourcing and may thus suffer from omitted variable bias.[15] Second, in the full specifications of the regression this study accounts for country-specific trends by including country-year interaction dummies rather than for simple year fixed effects.

Third, potential reverse causality problems are also addressed through an instrumental variable strategy. A reverse causality bias could arise due to selection effects in offshoring as suggested by, e.g., Antràs and Helpman (2004) and Wagner (2011). In this strand of

[13] In order to trace ownership changes over time, an attempt was made to use ownership information from past editions of the Amadeus database, where each of these editions would provide the ownership information at the current point in time. However, this strategy was discarded after careful inspection of the data, since Amadeus does not regularly update the ownership information and since the coverage for these variables is small in the earlier editions.

[14] An increase in offshoring implies by construction a decrease in the internal production if domestic outsourcing is held constant.

[15] An exception is Winkler (2010) who controls for domestic outsourcing using German input-output tables.

the literature highly productive firms have been found to be more likely to engage in offshoring than less productive firms. In the context of this study the reverse causality problem is attenuated by the fact that the independent variables are measured at a higher level of aggregation than the dependent variable, as in Geishecker and Görg (2008). Still, an instrumental variable strategy is pursued to check the results from the fixed effects estimations.

As instruments this study uses world offshoring measures for core, non-core, and service activities, and their interaction with the *MNE* dummy variable. These world offshoring measures are constructed as output-weighted averages of offshoring in all countries covered by WIOD. Changes in world offshoring reflect changes in offshoring costs around the world. Hence, we expect the instruments to be correlated with offshoring in given countries. At the same time, world offshoring is unlikely to be related to firm productivity other than through this cost reduction channel.[16]

2.5 Regression results

Table 2.8 shows the results from the fixed effects regressions. In the first specification *TFP* is regressed only on the offshoring variables and time dummies. The coefficient for offshoring of non-core activities is positive and statistically significant at the 1% level. The corresponding coefficients for core activities and services are statistically insignificant. In the second specification, the time dummies are replaced by country-year interaction dummies to account for country-specific productivity trends that are not due to offshoring. The results remain qualitatively the same as before but the adjusted R-squared is higher than before. Hence, these country-year dummies are kept included in the further specifications.

In the third specification, domestic outsourcing is additionally controlled for. The coefficient for offshoring of non-core activities remains positive and statistically significant at the 5% level. Additionally, service offshoring is positive and statistically significant at the 5% level and domestic outsourcing of services is negative and statistically significant at the 10% level. Hence, this shows that controlling for domestic outsourcing has consequences for the way one interprets the productivity effects of offshoring.

[16] It is possible, though, that industry specific shocks jointly determine firm productivities and world offshoring, in which case the instruments may become invalid. For instance, one may think of a technological invention which raises firm productivity and offshoring simultaneously. While I cannot address this problem in a general way, I am able to rule out biases related to technology by controlling for R&D intensities.

Tab. 2.8: Regression results

	Fixed effects regression				IV-FE regression	
	(1)	(2)	(3)	(4)	(5)	(6)
OffCore	0.006	0.002	-0.004	-0.004	0.011	0.008
	(-0.006)	(-0.004)	(-0.006)	(-0.006)	(-0.018)	(-0.015)
OffNoncore	0.034***	0.030***	0.025**	0.021*	0.070**	0.061**
	(-0.011)	-0.009)	(-0.011)	(-0.011)	(-0.03)	(-0.025)
OffService	-0.022	0.034	0.051**	0.046**	0.134	0.173
	(-0.069)	(-0.035)	(-0.020)	(-0.021)	(-0.229)	(-0.227)
DomCore			-0.003	-0.003	-0.002	0.002
			(-0.004)	(-0.004)	(-0.012)	(-0.009)
DomNoncore			-0.009	-0.009	-0.003	-0.007
			(-0.009)	(-0.008)	(-0.013)	(-0.013)
DomService			-0.024*	-0.024*	-0.041	-0.035
			(-0.012)	(-0.012)	(-0.053)	(-0.066)
MNE_OffCore				0.000	0.013	0.021
				(-0.004)	(-0.012)	(-0.014)
MNE_OffNoncore				0.019***	0.01	0.012
				(-0.005)	(-0.013)	(-0.012)
MNE_OffService				0.016*	0.231***	0.123*
				(-0.009)	(-0.088)	(-0.071)
R&D	0.023	0.022	0.021	0.021	0.009	0.012
	(-0.022)	(-0.019)	(-0.018)	(-0.018)	(-0.021)	(-0.017)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	–	Yes	Yes	Yes	–	Yes
Year FE	Yes	–	–	–	Yes	–
Kleibergen-Paap LM test: p-val					0.000	0.000
Kleibergen-Paap Wald test: F					60.027	97.97
Hansen J: p-val					0.093	0.095
Observations	783,827	783,827	783,827	595,685	595,685	595,685
Clusters	116	116	116	116	116	116
Adj R^2	0.044	0.092	0.093	0.094	0.040	0.075

Standard errors clustered at the country-industry level in parentheses. Instrumental variables are 1) the weighted average of world offshoring in t and t-1 for each of the offshoring variables and 2) the same instruments interacted with the dummy for multinational activity. ***, ** and * denote significance at the 1, 5 and 10% level respectively.

In specification four, offshoring is interacted with a dummy variable for multinational firms. Offshoring of non-core activities and service offshoring remain positive and statistically significant and the coefficient of domestic service outsourcing remains negative. Additionally, the coefficients of the interaction terms for non-core activities and services are positive and statistically significant. This suggests that there is an additional gain for multinational firms compared to non-multinationals.

In specification five and six, instrumental variable estimations are performed. Specification five includes year fixed effects, and specification six includes country-year fixed effects. The used instruments are the lagged and contemporaneous values of world offshoring (core, non-core, and service offshoring), which are obtained by taking the output-weighted average of offshoring in all countries covered by the WIOD data. The tests for underidentification (Kleibergen-Paap LM test: significant at 1%) and weak identification (Kleibergen-Paap Wald test: F-statistic > 10) are rejected. This confirms that the instruments are sufficiently correlated with offshoring. The test for overidentifying restrictions (Hansen J statistic) cannot be rejected at the 5% level. As to the results, the instrumental variable (IV) fixed effects regressions support the previous results in two respects. First, the coefficient of offshoring of non-core activities is positive and statistically significant. Second, the interaction term for service offshoring is positive and also statistically significant (with varying levels of statistical significance in the two specifications).

Overall these results suggest that offshoring of non-core activities and service offshoring have contributed to an increase in productivity, while there is no productivity effect due to offshoring of core activities. This result is consistent with the interpretation that productivity effects arise due to an induced specialisation. Manufacturing firms that move out services or non-core production activities to foreign suppliers benefit from the termination of their relatively unproductive activities, which allows them to specialise more on their relatively productive core activities.

Depending on the specification one also observes additional productivity effects for multinational firms. In the IV regressions there is an additional effect from service offshoring and in the simple fixed effects regressions there is also an additional effect from offshoring of non-core activities. This may be due to the fact that the MNE dummy is correlated with (unobserved) firm-level offshoring. Such a correlation is likely to exist because multinationals have more and better information about foreign markets and may therefore face lower sunk costs of offshoring (see e.g. Görg et al., 2008). In the extreme case that this correlation was 100% the interaction term would pick up the additional productivity gains for offshoring firms over non-offshoring firms. Still, there may be alternative explanations for this effect. For instance, MNEs could have systematically higher management skills, which allow them to adjust faster to changes in the general sourcing patterns.

In table 2.9, the robustness of the main results against several types of adjustments is checked: First, when using labour productivity as dependent variable, the results are shown to be qualitatively similar as before. Second, the fixed effects model is estimated

Tab. 2.9: Robustness checks

	Dependent variable	Subsamples		Subsamples	
	Labour Productivity	Non-MNEs	MNEs	Excl. ES, IT	2001-2008
OffCore	-0.002	-0.003	-0.009	-0.018*	-0.006
	(0.006)	(0.006)	(0.006)	(0.010)	(0.005)
OffNoncore	0.020*	0.024**	0.025**	0.018	0.028**
	(0.012)	(0.011)	(0.011)	(0.015)	(0.012)
OffService	0.044**	0.048**	0.059***	0.045***	0.041**
	(0.021)	(0.023)	(0.015)	(0.017)	(0.020)
DomCore	-0.002	-0.003	-0.005	-0.012	-0.009*
	(0.005)	(0.005)	(0.004)	(0.007)	(0.005)
DomNoncore	-0.007	-0.009	-0.009	-0.012	-0.014
	(0.009)	(0.009)	(0.008)	(0.014)	(0.011)
DomService	-0.021*	-0.025*	-0.018	-0.027	-0.035***
	(0.013)	(0.013)	(0.012)	(0.016)	(0.011)
MNE_OffCore	-0.001			0.001	-0.000
	(0.004)			(0.003)	(0.005)
MNE_OffNoncore	0.017***			0.013**	0.018***
	(0.005)			(0.005)	(0.005)
MNE_OffService	0.011			0.015	0.015
	(0.009)			(0.009)	(0.010)
R&D	0.021	0.022	0.021	0.028	-0.001
	(0.018)	(0.019)	(0.018)	(0.021)	(0.011)
Firm FE	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes
Observations	783,827	650,534	133,293	260,387	626,428
Clusters	116	116	115	90	116
Adj R^2	0.091	0.093	0.102	0.188	0.098

Standard errors clustered at the country-industry level in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level respectively.

for different subsamples of firms. Sample split regressions show that the productivity effects for MNEs and non-MNEs are similar though slightly larger for MNEs. Excluding Spain and Italy from the sample causes a negative coefficient for offshoring of core activities, while the remaining coefficients are consistent with previous results. Excluding the years 1996-2000 from the regressions causes no qualitative changes as compared to the full sample estimations.

In table 2.10 we split up the offshoring variables with respect to two groups of supplier countries and re-estimate the main specifications. Motivated by the stylized facts presented in section 2.3.2 we distinguish between offshoring to high-wage countries and offshoring to low-wage countries. The group of high-wage countries is given by the nine Western European countries analysed in this study and additionally by the group of other

Tab. 2.10: Effects of offshoring conditional on supplier regions

		TFP (1)	TFP (2)
Offshoring to high-wage countries	Core	-0.008	-0.007
		(0.007)	(0.007)
	Noncore	0.003	0.001
		(0.005)	(0.005)
	Service	-0.006	-0.010
		(0.016)	(0.018)
Offshoring to low-wage countries	Core	0.018	0.015
		(0.011)	(0.011)
	Noncore	0.061***	0.060***
		(0.023)	(0.023)
	Service	0.091***	0.092***
		(0.017)	(0.018)
Domestic outsourcing	Core	-0.001	-0.001
		(0.003)	(0.003)
	Noncore	-0.006	-0.006
		(0.009)	(0.009)
	Service	-0.012	-0.011
		(0.012)	(0.012)
MNE * Off. to high-wage countries	Core		-0.004
			(0.004)
	Noncore		0.011**
			(0.004)
	Service		0.010
			(0.010)
MNE * Off. to low-wage countries	Core		0.022**
			(0.009)
	Noncore		0.000
			(0.014)
	Service		-0.013
			(0.013)
R&D		0.020	0.019
		(0.018)	(0.017)
Observations		750,516	750,516
Adj R2		0.095	0.096

Standard errors clustered at the country-industry level in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level respectively. Firm fixed effects and country-year fixed effects are included.

high-wage OECD countries. The results show positive and statistically significant coefficients for service offshoring and offshoring of non-core activities in the case of low-wage supplier countries. The coefficients for high-wage supplier countries are statistically insignificant. This indicates that the the previous findings on positive productivity effects are in particular driven by offshoring to low-wage countries. A possible explanation for the differential effect is that offshoring to low-wage countries might be particularly driven

by cost reduction motives, while offshoring to high-wage countries might be driven by other factors, such as the location of suitable suppliers or the firms' market access strategies.

2.6 Conclusion

The inclusion of standard Feenstra and Hanson type offshoring measures in productivity models have been criticised because, by construction, offshoring cannot be accurately distinguished from domestic outsourcing and supplier changes (Castellani et al., 2013). Using data from the World Input Output Database (WIOD) this study analyses these variables systematically, and provides stylized facts on offshoring and domestic outsourcing in nine European countries between 1995 and 2008. Furthermore, combining the industry data on offshoring with a firm panel, this study estimates the productivity effects of service and material offshoring, while at the same time controlling for domestic outsourcing and supplier changes.

The main stylized facts are as follows: Offshoring has increased throughout virtually all countries and industries in Europe and it has increased with respect to different supplier regions, though strongest with the group of low-wage countries. The observed increase in material offshoring reflects genuine offshoring as well as a replacement of domestic by foreign suppliers. With respect to services there is evidence for domestic outsourcing and offshoring, but no evidence of systematic supplier changes. Overall, the share of internal production has gone down by 4.5 percentage points on average, thus evoking the question whether firms achieved productivity gains through this specialisation effort.

This question has been addressed through estimations based on combined industry and firm-level data. The main results are as follows: Offshoring of services and non-core manufacturing activities have contributed to an increase in productivity, while offshoring of core activities and domestic outsourcing have had no such effects. This suggests that offshoring raises productivity by allowing firms to further specialise on their core activities. The estimated productivity gains are in particular driven by offshoring to low-wage countries, and by the gains of multinational firms. For future research it would be desirable to use detailed firm level data on offshoring and domestic outsourcing and analyse the reasons behind the heterogeneous effects observed in this study.

2.7 Appendix

Tab. 2.11: Total factor productivity estimations

NACE	Industry	Labour		Capital		Obs	R^2
		β	SE	β	SE		
151	Production, processing, preserving of meat and meat products	0.801***	(0.003)	0.175***	(0.003)	22,839	0.89
152	Processing and preserving of fish and fish products	0.721***	(0.009)	0.196***	(0.007)	4,143	0.85
153	Processing and preserving of fruit and vegetables	0.674***	(0.008)	0.257***	(0.007)	7,755	0.86
154	Vegetable and animal oils and fats	0.878***	(0.012)	0.212***	(0.01)	3,247	0.83
155	Dairy products	0.811***	(0.006)	0.199***	(0.005)	9,062	0.92
156	Grain mill products, starches and starch products	0.812***	(0.009)	0.221***	(0.006)	4,837	0.89
157	Prepared animal feeds	0.861***	(0.008)	0.162***	(0.006)	6,778	0.89
158	Other food products	0.733***	(0.004)	0.253***	(0.003)	30,095	0.88
159	Beverages	0.856***	(0.006)	0.198***	(0.005)	15,245	0.86
160	Tobacco products	0.816***	(0.049)	0.364***	(0.037)	379	0.88
171	Preparation and spinning of textile fibres	0.777***	(0.008)	0.120***	(0.005)	7,063	0.86
172	Textile weaving	0.793***	(0.007)	0.107***	(0.005)	8,393	0.85
173	Finishing of textiles	0.764***	(0.012)	0.146***	(0.006)	5,211	0.83
174	Made-up textile articles, except apparel	0.785***	(0.009)	0.100***	(0.006)	4,202	0.84
175	Other textiles	0.832***	(0.008)	0.147***	(0.005)	6,664	0.86
176	Knitted and crocheted fabrics	0.757***	(0.017)	0.124***	(0.012)	1,475	0.78
177	Knitted and crocheted articles	0.758***	(0.009)	0.124***	(0.006)	4,680	0.85
181	Leather clothes	0.816***	(0.023)	0.098***	(0.016)	661	0.82
182	Other wearing apparel and accessories	0.746***	(0.004)	0.161***	(0.003)	21,617	0.78
183	Dressing and dyeing of fur; articles of fur	0.663***	(0.034)	0.089***	(0.02)	527	0.62
191	Tanning and dressing of leather	0.768***	(0.009)	0.119***	(0.005)	4,888	0.85
192	Luggage, handbags and the like, saddler	0.740***	(0.011)	0.160***	(0.007)	3,098	0.82
193	Footwear	0.736***	(0.006)	0.212***	(0.003)	11,000	0.83
201	Sawmilling and planing of wood; impregnation of wood	0.779***	(0.006)	0.175***	(0.004)	10,843	0.83
202	Veneer sheets; panels and boards	0.843***	(0.011)	0.190***	(0.006)	3,068	0.90
203	Builders, carpentry and joinery	0.874***	(0.006)	0.107***	(0.004)	12,282	0.86
204	Wooden containers	0.862***	(0.01)	0.086***	(0.006)	5,500	0.77
205	Other products of wood, cork, straw and plaiting materials	0.755***	(0.009)	0.163***	(0.006)	5,386	0.83
211	Pulp, paper and paperboard	0.819***	(0.01)	0.231***	(0.007)	4,980	0.93
212	Articles of paper and paperboard	0.846***	(0.005)	0.142***	(0.003)	16,957	0.90
221	Publishing	0.870***	(0.005)	0.101***	(0.003)	19,919	0.83
222	Printing and service activities related to printing	0.863***	(0.004)	0.120***	(0.002)	33,389	0.87
223	Reproduction of recorded media	0.812***	(0.033)	0.117***	(0.022)	470	0.81
241	Basic chemicals	0.833***	(0.007)	0.190***	(0.005)	13,717	0.89
242	Pesticides and other agro-chemical products	1.086***	(0.027)	0.052***	(0.017)	849	0.91
243	Paints, varnishes and similar coatings	0.920***	(0.009)	0.112***	(0.006)	6,495	0.89
244	Pharmaceuticals, medicinal chemicals and botanical products	0.999***	(0.008)	0.040***	(0.006)	8,054	0.88
245	Soap and detergents, cleaning, perfumes and toilet preparations	0.899***	(0.009)	0.139***	(0.006)	7,429	0.88
246	Other chemical products	0.841***	(0.008)	0.158***	(0.005)	9,142	0.88
247	Man-made fibers	0.771***	(0.032)	0.189***	(0.023)	659	0.89
251	Rubber products	0.850***	(0.007)	0.132***	(0.005)	7,344	0.91
252	Plastic products	0.843***	(0.003)	0.139***	(0.002)	45,457	0.88
261	Glass and glass products	0.823***	(0.008)	0.206***	(0.005)	7,397	0.92
262	Non-refractory ceramic goods	0.785***	(0.01)	0.192***	(0.007)	4,152	0.89
263	Ceramic tiles and flags	0.800***	(0.017)	0.196***	(0.011)	2,153	0.92
264	Bricks, tiles and construction products, in baked clay	0.808***	(0.012)	0.204***	(0.008)	4,489	0.86
265	Cement, lime and plaster	0.773***	(0.02)	0.334***	(0.012)	2,242	0.90
266	Articles of concrete, plaster and cement	0.763***	(0.005)	0.196***	(0.003)	22,291	0.84
267	Ornamental and building stone	0.716***	(0.008)	0.173***	(0.004)	8,013	0.78
268	Other non-metallic mineral products	0.672***	(0.008)	0.235***	(0.006)	3,528	0.88
271	Basic iron and steel and of ferro-alloys	0.782***	(0.012)	0.220***	(0.008)	4,093	0.92
272	Tubes	0.853***	(0.012)	0.131***	(0.008)	2,789	0.91
273	Other first processing of iron and steel	0.836***	(0.01)	0.164***	(0.007)	3,570	0.90
274	Basic precious and non-ferrous metals	0.801***	(0.012)	0.177***	(0.008)	5,151	0.90
275	Casting of metals	0.834***	(0.006)	0.139***	(0.004)	8,117	0.92

NACE	Industry	Labour		Capital		Obs	R^2
		β	SE	β	SE		
281	Structural metal products	0.859***	(0.003)	0.138***	(0.002)	47,397	0.83
282	Tanks, reservoirs and containers of metal	0.838***	(0.009)	0.144***	(0.005)	5,078	0.87
283	Steam generators, except central heating hot water boilers	0.979***	(0.03)	0.0268	(0.018)	346	0.93
284	Forging, pressing, stamping and roll forming of metal	0.806***	(0.005)	0.160***	(0.003)	12,777	0.89
285	Treatment metals; general mechanical engineering	0.837***	(0.003)	0.115***	(0.002)	52,991	0.87
286	Cutlery, tools and general hardware	0.860***	(0.006)	0.119***	(0.004)	10,624	0.89
287	Other fabricated metal products	0.848***	(0.004)	0.141***	(0.002)	30,356	0.89
291	Machinery for mechanical power	0.905***	(0.005)	0.094***	(0.003)	16,495	0.92
292	Other general purpose machinery	0.900***	(0.003)	0.0773***	(0.002)	50,723	0.88
293	Agricultural and forestry machinery	0.892***	(0.008)	0.111***	(0.005)	6,464	0.89
294	Machine-tools	0.870***	(0.006)	0.099***	(0.004)	10,165	0.89
295	Other special purpose machinery	0.896***	(0.004)	0.094***	(0.002)	28,363	0.89
296	Weapons and ammunition	0.983***	(0.024)	0.085***	(0.016)	710	0.93
297	Domestic appliances n.e.c.	0.891***	(0.012)	0.097***	(0.008)	3,617	0.91
300	Office machinery and computers	0.947***	(0.012)	0.079***	(0.009)	4,105	0.81
311	Electric motors, generators and transformers	0.876***	(0.01)	0.110***	(0.007)	5,760	0.85
312	Electricity distribution and control apparatus	0.860***	(0.01)	0.107***	(0.007)	5,808	0.85
313	Insulated wire and cable	0.893***	(0.015)	0.105***	(0.011)	2,443	0.87
314	Accumulators, primary cells and primary batteries	0.856***	(0.03)	0.119***	(0.021)	411	0.93
315	Lighting equipment and electric lamps	0.810***	(0.012)	0.131***	(0.008)	4,660	0.82
316	Electrical equipment n.e.c.	0.834***	(0.006)	0.126***	(0.004)	15,548	0.86
321	Electronic valves and tubes; other electronic components	0.917***	(0.01)	0.085***	(0.007)	6,793	0.81
322	Television and radio transmitters; apparatus for telephony	0.934***	(0.013)	0.074***	(0.009)	4,279	0.83
323	Television and radio receivers, sound or video recording	0.971***	(0.025)	-0.011	(0.016)	1,354	0.77
331	Medical and surgical equipment	0.831***	(0.008)	0.138***	(0.005)	8,238	0.87
332	Instruments for measuring, checking, testing, navigating	0.934***	(0.006)	0.066***	(0.004)	9,118	0.90
333	Industrial process control equipment	0.890***	(0.015)	0.091***	(0.009)	1,567	0.86
334	Optical instruments and photographic equipment	0.909***	(0.015)	0.064***	(0.011)	2,013	0.88
335	Watches and clocks	0.825***	(0.033)	0.060***	(0.018)	491	0.84
341	Motor vehicles	0.859***	(0.015)	0.150***	(0.011)	2,447	0.96
342	Bodies for motor vehicles; trailers and semi-trailers	0.850***	(0.008)	0.126***	(0.005)	6,810	0.87
343	Parts and accessories for motor vehicles and engines	0.815***	(0.006)	0.152***	(0.005)	9,980	0.91
351	Building and repairing of ships and boats	0.816***	(0.007)	0.156***	(0.005)	6,774	0.87
352	Railway and tramway locomotives and rolling stock	0.900***	(0.021)	0.089***	(0.014)	1,313	0.91
353	Aircraft and spacecraft	0.991***	(0.012)	0.061***	(0.009)	2,117	0.94
354	Motorcycles and bicycles	0.816***	(0.015)	0.132***	(0.011)	1,649	0.90
355	Other transport equipment n.e.c.	0.952***	(0.021)	0.076***	(0.013)	845	0.89
361	Furniture	0.827***	(0.004)	0.125***	(0.002)	34,876	0.86
362	Jewellery and related articles	0.832***	(0.01)	0.101***	(0.006)	4,423	0.82
363	Musical instruments	0.811***	(0.041)	0.103***	(0.019)	410	0.81
364	Sports goods	0.837***	(0.017)	0.117***	(0.011)	1,605	0.86
365	Games and toys	0.766***	(0.019)	0.155***	(0.012)	1,529	0.81
366	Miscellaneous manufacturing n.e.c.	0.812***	(0.006)	0.136***	(0.004)	10,612	0.88

Notes: This table shows the results from the TFP regressions, according to equation 2.3. NACE industries 23 and 37 are excluded due to lack of observations. Robust standard errors in parentheses. *** denotes significance at the 1% level.

Tab. 2.13: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Domestic outsourcing of core activities	1,638	8.3685	6.0138	0	27.5141
Domestic outsourcing of non-core activities	1,638	9.7234	5.9132	1.6447	33.2059
Domestic outsourcing of services	1,638	6.9131	2.4848	1.8647	18.539
Offshoring of core activities	1,638	7.0806	5.2949	0.4293	30.2627
Offshoring of non-core activities	1,638	7.1008	4.3804	1.287	27.8508
Offshoring of services	1,638	1.359	1.3478	0.1547	12.0276
Value added	783,827	14.1159	1.3387	11.5129	24.1152
Employees	783,827	3.4074	1.2369	1.6094	12.4783
Tangible capital	783,827	13.2296	1.8413	8.5171	22.9413
Total factor productivity	783,827	9.3979	0.7324	2.7403	13.3466
MNE dummy	783,827	0.1701	0.3757	0	1

Source: WIOD, Amadeus, own calculations.

Tab. 2.12: Average performance by industry

Nace	Industry	L	K (th. €)	VA (th. €)	TFP	VA / L	Obs
15-16	Food & tobacco	88	5,144	5,275	8.4	50,972	87,694
17-18	Textiles & clothing	59	1,566	2,501	9.6	44,705	51,468
19	Leather	42	858	1,559	9.0	38,252	16,887
20	Wood	43	1,979	1,948	9.3	43,927	31,707
21-22	Paper & publishing	80	4,891	5,774	9.6	58,095	63,650
24	Chemicals	152	12,846	16,125	9.5	76,387	38,678
25	Rubber, plastics	83	3,246	4,552	9.4	51,840	44,055
26	Glass, ceramics	75	4,575	4,804	8.7	54,451	48,569
27-28	Metals	63	2,550	3,387	9.4	47,193	154,724
29	Machinery	79	2,050	4,706	10.0	53,811	98,785
30-33	Electrical & medical	139	4,499	12,691	10.0	64,368	61,655
34-35	Transport equipment	346	16,941	24,473	9.5	51,809	27,645
36-37	Manufacturing, n.e.c	48	1,228	1,964	9.5	41,473	42,186

This table shows the average performance of firms by industry. Source: Amadeus, own calculations.

Tab. 2.14: Data sources

Variable	Data source
Offshoring	World Input Output Database
R&D expenditures	ANBERD
Firm-level variables	Amadeus
Price deflators	EU KLEMS; STAN
Exchange rates	EUROSTAT

2.8 Bibliography

Amiti, Mary and Shang-Jin Wei, "Fear of Service Outsourcing: Is It Justified?," *Economic Policy*, 2005, *20* (42), 308–347.

_ **and** _ , "Service Offshoring and Productivity: Evidence from the US," *World Economy*, 2009, *32* (2), 203–220.

Antràs, Pol and Elhanan Helpman, "Global Sourcing," *Journal of Political Economy*, 2004, *112* (3), 552–580.

Blinder, Alan S., "Offshoring: The Next Industrial Revolution?," *Foreign Affairs*, 2006, *85* (2), 113–128.

_ , "How Many US Jobs Might Be Offshorable?," *World Economics*, 2009, *10* (2), 41–78.

Castellani, Davide, Luca de Benedictis, and Daniel Horgos, "Can We Really Trust Offshoring Indices?," *Structural Change and Economic Dynamics*, 2013, *25*, 159–172.

Egger, Hartmut and Peter Egger, "International Outsourcing and the Productivity of Low-Skilled Labor in the EU," *Economic Inquiry*, 2006, *44* (1), 98–108.

Feenstra, Robert C. and Gordon H. Hanson, "Globalization, Outsourcing, and Wage Inequality," *The American Economic Review*, 1996, *86* (2), 240–245.

_ **and** _ , "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990," *The Quarterly Journal of Economics*, 1999, *114* (3), 907–940.

_ **and J. Bradford Jensen**, "Evaluating Estimates of Materials Offshoring from US Manufacturing," *Economics Letters*, 2012, *117* (1), 170–173.

Geishecker, Ingo, "Assessing the Extent and Development of International Outsourcing in the Euro Area," Technical Report, University of Göttingen 2007.

_ **and Holger Görg**, "Winners and Losers: a Micro-Level Analysis of International Outsourcing and Wages," *Canadian Journal of Economics*, 2008, *41* (1), 243–270.

Glass, Amy J. and Kamal Saggi, "Innovation and Wage Effects of International Outsourcing," *European Economic Review*, 2001, *45* (1), 67–86.

Görg, Holger and Aoife Hanley, "International Outsourcing and Productivity: Evidence from the Irish Electronics Industry," *The North American Journal of Economics and Finance*, 2005, *16* (2), 255–269.

_ and _, "Services Outsourcing and Innovation: An Empirical Investigation," *Economic Inquiry*, 2010.

_ , _ , and Eric Strobl, "Productivity Effects of International Outsourcing: Evidence from Plant-Level Data," *Canadian Journal of Economics*, 2008, *41* (2), 670–688.

Grossman, Gene M. and Esteban Rossi-Hansberg, "Trading Tasks: A Simple Theory of Offshoring," *American Economic Review*, 2008, *98* (5), 1978–1997.

Hijzen, Alexander, Holger Görg, and Robert C. Hine, "International Outsourcing and the Skill Structure of Labour Demand in the United Kingdom," *The Economic Journal*, 2005, *115* (506), 860–878.

_ , Tomohiko Inui, and Yyasuyuki Todo, "Does Offshoring Pay? Firm-level Evidence from Japan," *Economic Inquiry*, 2010, *48* (4), 880–895.

Hummels, David, Jun Ishii, and Kei-Mu Yi, "The Nature and Growth of Vertical Specialization in World Trade," *Journal of International Economics*, 2001, *54* (1), 75–96.

Kohler, Wilhelm K. and Jens Wrona, "Offshoring Tasks, Yet Creating Jobs?," Working paper, University of Tübingen 2010.

Mitra, Devashish and Priya Ranjan, "Offshoring and Unemployment: The Role of Search Frictions Labor Mobility," *Journal of International Economics*, 2010, *81* (2), 219–229.

Moulton, Brent R., "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units," *The Review of Economics and Statistics*, 1990, *72* (2), 334–338.

Olsen, Karsten B., "Productivity Impacts of Offshoring and Outsourcing: A Review," OECD Science, Technology and Industry Working Papers 2006/1, OECD 2006.

Timmer, Marcel et al., "The World Input-Output Database (WIOD): Contents, Sources and Methods," Working Paper 10, WIOD 2012.

Wagner, Joachim, "Offshoring and Firm Performance: Self-Selection, Effects on Performance, or Both?," *Review of World Economics*, 2011, *147*, 217–247.

Winkler, Deborah, "Services Offshoring and its Impact on Productivity and Employment: Evidence from Germany, 1995-2006," *The World Economy*, 2010, *33* (12), 1672–1701.

_ **and William Milberg**, "Errors from the Proportionality Assumption in the Measurement of Offshoring: Application to German Labor Demand," SCEPA Working Papers 12, Schwartz Center for Economic Policy Analysis and New School for Social Research 2009.

3. OFFSHORING AND LABOUR MARKET INEQUALITIES

3.1 Introduction

Labour market inequalities between skilled and less skilled people have widened across the developed world since the 1980s. The United States and the United Kingdom have experienced particularly sharp increases in wage inequalities, while continental Europe has experienced a combination of moderately increasing wage inequalities and/or increasing unemployment rates among the less skilled (e.g. Freeman and Katz, 1995; Nickell and Bell, 1996; Gottschalk and Smeeding, 1997; Machin and van Reenen, 1998; Acemoglu, 2003; OECD, 2011). For the more recent past, several studies have documented a polarisation of employment and/or wages to the detriment of medium skilled labour (e.g. Spitz-Oener, 2006; Goos et al., 2009; Autor and Dorn, 2013).

The forces behind these trends have been subject to extensive research.[1] One strand of the literature has strived to identify the common determinants of the growth in labour market inequalities. This literature argues that market forces – such as technological change, trade, and offshoring – have increased the relative demand for skills, over and above the increase in relative skill supply. A second strand of the literature has strived to explain why wage inequalities have grown less in continental Europe than in Anglo-Saxon countries.[2] This literature stresses the role of institutional forces in Europe, such as the broad coverage of collective bargaining, unemployment benefits or high minimum wages, which hold wage inequalities low but cause unemployment among the less skilled.[3] Thus, it has been argued that Anglo-Saxon wage inequalities and continental European unemployment are essentially two sides of the same coin (Krugman, 1994).

The paper contributes mainly to the first strand of the literature. We provide evidence on changes in the relative demand for skills in 28 manufacturing and service industries in

[1] See Katz and Autor (1999) for an overview over the different strands of research in this field.
[2] See Acemoglu (2003) for a summary of the main arguments in this literature.
[3] See for instance Fitzenberger (1999) for Germany.

Germany between 1995 and 2007 and analyse the explanatory power of several demand side factors by estimating systems of wage bill share equations, following Berman et al. (1994). Our particular focus is on the role of offshoring but we also account for different aspects of technological change. In addition, we also link our work to the second strand of the literature by analysing whether the labour market adjusts to offshoring through changes in relative wages or through changes in relative employment.

Theoretically, the hypothesis that offshoring raises the relative demand for high skilled labour is grounded on the assumption that firms in the developed "North" are offshoring their low-skill intensive stages of production (or tasks) to the less-developed "South". This assumption can be rationalised in two different ways. First, in a world where factor price equalisation fails to hold (e.g. because of the presence of non-tradable goods), the relative wage of low skilled labour is smaller in the South than in the North due to its relatively abundance in low skilled labour. This allows firms in the North to arbitrage on factor price differences by offshoring low-skill intensive tasks to the South (e.g. Feenstra and Hanson, 1996a; Deardorff, 2001; Kohler, 2004).

Second, the level of offshoring costs likely differs depending on the nature of the offshored tasks. In particular, researchers have argued that offshoring is relatively cheap if tasks are routine and codifiable and if they can be carried out without physical presence at some location or without face-to-face contact with customers (Leamer and Storper, 2001; Autor et al., 2003; Blinder, 2006, 2009). The criteria of routineness and codifiability are arguably more often satisfied in case of low skilled labour such that the immediate offshoring threat may indeed be larger for this group. Yet, some recent studies have argued that this simple relation between skills and offshorability does not hold in the service sector (Blinder, 2006, 2009; Acemoglu and Autor, 2011; Autor and Dorn, 2013). Jobs of low skilled labour in the service sector are often physically bound to a location and therefore cannot be offshored. Instead, these studies argue that the wave of computerization has exposed medium skilled labour in the service sector to offshoring and automation, thus contributing to a polarisation in employment and wages.

While it is evident that offshoring causes immediate job losses which may be concentrated among particular skill groups, it is less evident how these skill groups are affected in general equilibrium. According to the seminal work by Feenstra and Hanson (1996a,b, 1999) the effect of offshoring on the relative wages of low skilled labour is unambiguously negative. In Feenstra and Hanson's theoretical model the US offshores production stages to Mexico which are perceived as low-skill intensive in the US and as high-skill

intensive in Mexico, due to differences in their levels of economic development. Under this assumption offshoring increases the relative demand and, consequently, the relative wages of high skilled labour in both countries. In this sense outsourcing operates in the same way as a skill-biased technical change that occurs simultaneously in both countries (Kohler, 2001).

The theoretical literature that followed Feenstra and Hanson has shown that under less restrictive assumptions the effects are more ambiguous.[4] If one allows for outsourcing in more than one final good sector then, as Jones and Kierzkowski (2001) put it, "almost anything can happen". In Grossman and Rossi-Hansberg (2008) this ambiguity is pinned down to three partly opposing effects: Low skilled labour suffers from negative labour-supply and relative-price effects but gains from a positive productivity effect. The negative labour supply effect results from the initial displacement of low skilled labour which works like an increase in the supply of low skilled labour. To restore the full employment equilibrium wages of low skilled labour have to fall. The negative relative-price effect occurs in large economies because offshoring reduces the relative price of the low-skill intensive good. Following the Stolper-Samuelson theorem this reduces the relative wage of low skilled labour. The positive productivity effect follows from the greater cost savings realised by the low-skill intensive sector. The low-skill intensive sector expands relative to the high-skill intensive sector and thus increases the relative demand for low skilled labour.[5] The overall effect on the wages of low skilled labour cannot be generally established in Grossman and Rossi-Hansberg (2008).

Empirically, there has been much support on the hypothesis that offshoring is skill biased.[6] Early evidence on the United States (Feenstra and Hanson, 1996b, 1999) and the United Kingdom (Anderton and Brenton, 1999) shows that offshoring can explain between 10 and 50% of the increase in the wage bill shares of high skilled labour in the 1970s and 1980s. Later studies extend the analysis to more than two skill-groups. Morrison Paul and Siegel (2001) distinguish four skill groups for the US and find that the lowest two groups are negatively affected and the highest group is positively affected, though offshoring has a smaller impact than technological change. Hijzen et al. (2005) distinguish three skill groups of the UK and find negative effects for low skilled labour but no signif-

[4] See for instance Arndt (1997) for positive effects for (low skilled) labour, and Venables (1999), Deardorff (2001), Jones and Kierzkowski (2001), Kohler (2004), Grossman and Rossi-Hansberg (2008) for ambiguous effects.

[5] Empirically, productivity effects of offshoring have been identified by Görg and Hanley (2005), Egger and Egger (2006), Görg et al. (2008), Amiti and Wei (2009), and Schwörer (2013).

[6] See Crinò (2009) for a survey of the empirical literature.

icant effects for medium and high skilled labour. Crinò (2010, 2012) and Geishecker and Görg (2013) show that the skill-bias also applies in case of service offshoring.

In terms of continental Europe there exists similar evidence for France (Strauss-Kahn, 2004), Spain (Minondo and Rubert, 2006), Italy (Helg and Tajoli, 2005), Austria (Egger and Egger, 2003, 2005; Lorentowicz et al., 2008) and Sweden (Ekholm and Hakkala, 2006). Note however that most of these studies model only the employment effects of offshoring and neglect potential wage effects, thus potentially underestimating the overall impact of offshoring. Turning to Germany, early evidence by Falk and Koebel (2002) shows that offshoring between 1978 and 1990 has negatively affected the demand for low skilled labour, whereas the effects for medium and high skilled labour are not statistically significant. Geishecker (2006) finds that offshoring to Central and Eastern Europe (CEEC) between 1991 and 2000 explains about half of the decline in the wage bill shares of low skilled labour. Schöller (2007) is the first to analyse the effects of service offshoring. She finds a negative impact of service offshoring for low skilled labour. Becker et al. (2013) analyse effects on the workforce composition in German multinational enterprises between 1998 and 2001. They find that offshoring causes a shift in favour of high skilled labour and in favour of non-routine and interactive tasks, but not in case of offshoring to CEEC. Baumgarten et al. (2013) analyse individual level data for the period 1991 to 2006 and allow for mobility of workers between industries within occupations. They find that offshoring has an even larger negative impact on wages of low skilled workers if such cross industry effects are taken into account.

In this paper we provide evidence on the effects of offshoring on labour market inequalities in Germany of the recent past (1995 - 2007) and explore several new aspects: First, we distinguish between the manufacturing sector and the service sector, as well as between three different skill groups. This enables us to address the hypothesis raised by Acemoglu and Autor (2011) and Autor and Dorn (2013) that, in the service sector, offshoring and technological change lead to polarisation rather than skill bias. Second, we explicitly analyse whether offshoring affects the labour market through changes in relative wages or through changes in relative employment. In this way we indirectly shed light on the rigidity of wage structures and the role of labour market institutions in Germany. Third, we incorporate several dimensions of offshoring into our estimations that have only recently entered the literature. In particular we distinguish between different types of offshored inputs (materials vs. services) and between different offshoring destinations (China, CEEC, OECD countries, and remaining low-wage countries). Fourth, we reduce problems of omitted variable bias that have been present in many previous studies

by controlling for domestic outsourcing.

Our findings can be summarised as follows: Offshoring is on average biased in favour of high skilled labour and in disfavour of low skilled labour. This effect is strongly driven by material offshoring and offshoring to Central and Eastern Europe, and predominantly works through adjustments in relative wages. The latter finding suggests that German wage structures are not as rigid as previous studies suggest. While our main findings hold for the manufacturing sector, we find the opposite direction of bias for the service sector. This finding is in line with the hypothesis that low skilled labour in the service sector is shielded from offshoring by the nature of the tasks they perform. Finally, we also find patterns of polarisation in favour of both high and low skilled labour. However, this pattern is not driven by offshoring but by technological change.

The remainder of this study is structured as follows. Section 3.2 describes the data and presents stylized facts on labour market variables and offshoring, section 3.3 derives the empirical model and discusses our econometric implementation, section 3.4 presents the econometric results, and section 3.5 concludes.

3.2 Data, measurement, and stylized facts

3.2.1 Data and measurement

This paper uses industry-level data for Germany in the period 1995 to 2007. The sample comprises 14 manufacturing industries (NACE revision 1 codes 15-37) and 14 service industries (40-74) mainly measured at the 2-digit level.[7] From the EUKLEMS database we retrieve information on wage bills, total hours worked, and number of employees. The first two of these variables can be decomposed into the shares contributed by high, medium, and low skilled labour. To obtain a corresponding decomposition for the number of employees we use additional data from the Labour Force Survey (LFS) of the European Union. Offshoring variables are based on data from the World Input Output Database (WIOD) as in Schwörer (2013). WIOD contains information on the value of material and service inputs used by German industries and on the source countries from which these

[7] The level of industry aggregation and the sample period are dictated by the main data sources used, EUKLEMS and WIOD. The sample period ends in 2007 since more recent data for several variables are only available for the NACE revision 2 industry classification, which cannot accurately be harmonized at the 2-digit level with NACE revision 1.

inputs are obtained. This study defines offshoring (OS) of industry j in year t as the share of imported inputs (M) from all 28 industries ($i = 1,\ldots,I$) and all countries ($c = 1,\ldots,C$) in output (Y):

$$OS_{jt} = \frac{\sum_{i=1}^{I}\sum_{c=1}^{C} M_{ic,jt}}{Y_{jt}} \tag{3.1}$$

OS is similar to the well-known broad offshoring measure introduced by Feenstra and Hanson (1996b) but differs in three ways: 1. OS comprises service offshoring in addition to material offshoring. 2. Imports are scaled by output rather than non-energy inputs. This scaling is important for our econometric analysis because it allows us (jointly with the fact that we control for domestic outsourcing) to identify how offshoring of inhouse production affects relative skill demand. We thereby avoid confounding offshoring of inhouse production with the substitution of domestic suppliers by foreign suppliers.[8] 3. We directly obtain industry-specific imports ($M_{ic,jt}$) from WIOD, whereas Feenstra and Hanson derive them from domestic input-output tables based on a restrictive proportionality assumption for imports.[9] But note that WIOD data are themselves based on a similar, though less restrictive, type of proportionality assumption (Timmer et al., 2012).

We complement this broad offshoring measure with more detailed measures by restricting the range of imports: First, we distinguish between offshoring to Central and Eastern European countries (CEEC), China, OECD countries (excluding CEEC), and the rest of the world (RoW). Second, we distinguish between material offshoring and service offshoring.[10] Third, we define domestic outsourcing (DO) as the share of domestic inputs in output, in complete analogy to the broad offshoring measure.

3.2.2 Stylized facts on the labour market and offshoring

At the aggregate level we find that the share of high skilled employment in total employment has grown by $\Delta S_H = 3.8\%$ between 1995 and 2007. We analyse in the following to

[8] See section 3.3.2 as well as Schwörer (2013) and Castellani et al. (2013) for more details.

[9] This proportionality assumption has been criticised as highly restrictive by Feenstra and Jensen (2012), Puzzello (2012), and Winkler and Milberg (2009).

[10] For instance, offshoring to China is defined as the share of (material and service) imports from China in output. Similarly, service offshoring is defined as the share of service imports (from all countries) in output.

which extent this growth can be attributed to employment shifts between industries or to growing skill-intensities within industries, following the decomposition in Berman et al. (1994):

$$\Delta S_H = \sum_j \Delta F_j \bar{S}_{Hj} + \sum_j \Delta S_{Hj} \bar{F}_j \tag{3.2}$$

where S_{Hj} is the employment share of high skilled labour in industry j, F_j is the fraction of industry j in aggregate employment, Δ denotes the change in variables between 1995 and 2007, and bars denote time averages. The first term on the right hand side captures the contribution of between-industry shifts and the second term captures the contribution of within-industry shifts.[11]

Our decomposition shows that 31% of the aggregate growth in the share of high skilled employment is due to between-industry shifts and 69% is due to within-industry shifts. Similar numbers are obtained when we decompose the employment shares of medium (34 vs. 66%) or low skilled labour (22 vs. 78%).[12] This finding has an important implication. It suggests that neoclassical trade theory, based on the Stolper-Samuelson theorem, has only limited potential to explain the observed trends. According to the Stolper-Samuelson theorem the rising demand for high skilled labour in the Germany is due to growing import competition from low-skill abundant countries. However, this link would require a large shift in employment towards the high-skill intensive industries (i.e. large between-industry shifts) and a decline of skill-intensities within sectors. By contrast, this decomposition suggests that factors which affect skill-intensities within industries, such as offshoring and skill-biased technological change, may have larger explanatory power. Before we turn to the analysis of these relationships, we document some stylized facts on labour market outcomes and offshoring.

Table 3.1 summarizes trends in labour market outcomes by skill group. The numbers represent aggregate changes between 1995 and 2007 in %. We observe that the wage bill of high skilled labour has increased by 38%, whereas the wage bill of medium and low skilled labour has increased by only about 4% each. The wage bill share can be further

[11] The first term is the weighted sum of changes in relative industry size, with the average skill-intensity as weights. The term is positive if skill-intensive industries grow and unskill-intensive industries shrink (in relative terms), reflecting between-industry shifts in employment towards the skill-intensive industry. The second term is the weighted sum of changes in industry skill-intensities, with the average industry size as weights. If this term is positive it reflects within-industry increases in skill-intensities.

[12] The results reported here are based on the total number of hours worked by high skilled labour as a measure of high skilled employment. However, results are similar when we use the number of high skilled employees.

Tab. 3.1: Aggregate changes in labour market outcomes by skill group (1995-2007; %)

	High	Medium	Low
Wage bill	37.72	3.94	4.34
Number of employees	11.21	1.41	5.33
Hours worked per employee	6.71	-8.39	-13.11
Hourly wage	16.04	11.84	14.04

This table shows the aggregate growth rates between 1995 and 2007 of labour market outcomes by skill group (in %). For instance, the upper-left element means that the wage bill of high skilled labour has increased between 1995 and 2007 by 37.72%. Note that by definition the wage bill can be written as the product of the other three variables.

Tab. 3.2: Changes in labour market outcomes by skill group and main economic sector (1995-2007;%)

	Manufacturing sector			Service sector		
	High	Medium	Low	High	Medium	Low
Wage bill	37.60	3.46	-17.46	37.78	4.21	24.91
Number of employees	-8.68	-8.99	-18.01	21.32	6.12	19.53
Hours worked per employee	12.73	-7.54	-12.65	4.01	-8.79	-13.27
Hourly wage	33.64	22.98	15.28	9.20	7.61	20.50

This table shows the aggregate growth rates between 1995 and 2007 of labour market outcomes by skill group and by main economic sector (in %). For instance, the upper-left element means that the wage bill of high skilled labour in the manufacturing sector has increased between 1995 and 2007 by 37.60%. Note that by definition the wage bill can be written as the product of the other three variables.

decomposed into three components: number of employees, hours worked per employee, and the hourly wage rate. In terms of employment we observe the largest growth rates for high skilled labour, the second largest growth rate for low skilled labour, and the smallest growth rate for medium skilled labour. In terms of the hourly wage a similar though somewhat weaker pattern applies.[13] In terms of the hours worked we observe a clear linear bias in favour of higher skilled labour. Medium and low skilled labour has even reduced the average working time.

Table 3.2 replicates the stylized facts of table 3.1 for the manufacturing sector and the service sector individually. We observe that total employment has fallen in the manufacturing sector and has grown in the service sector. Beyond this general pattern there are some remarkable differences between the two sectors with respect to skill-specific trends.

[13] The previous evidence on wage inequalities in Germany is mixed. Several studies have highlighted the stability of Germany's wage dispersion (Abraham and Houseman, 1995; Freeman and Schettkat, 2001; Prasad, 2004). By contrast, recent studies provide evidence of growing wage inequalities since the 1980s and even an acceleration of this trend in the mid-1990s (Dustmann et al., 2009; OECD, 2011; Card et al., 2013).

Tab. 3.3: Aggregate changes in offshoring, domestic outsourcing, and inhouse production (1995-2007)

	Total			Manufacturing			Services		
	1995	2007	Δ%	1995	2007	Δ%	1995	2007	Δ%
Inhouse production	49.83	44.90	-10%	36.48	30.95	-15%	59.01	56.27	-5%
Domestic outsourcing	40.17	38.83	-3%	46.96	42.66	-9%	35.50	35.70	1%
Offshoring	7.37	13.10	78%	13.05	22.17	70%	3.46	5.71	65%
... of materials	5.34	9.07	70%	10.38	17.16	65%	1.88	2.47	31%
... of services	1.40	2.62	87%	1.38	2.31	67%	1.41	2.87	104%
... to OECD countries	5.28	7.68	45%	9.35	12.65	35%	2.48	3.63	46%
... to CEEC	0.51	1.61	216%	0.87	2.89	232%	0.26	0.56	115%
... to China	0.28	1.00	257%	0.44	1.60	264%	0.17	0.50	194%
... to RoW	1.30	2.82	172%	2.39	5.03	110%	0.56	1.02	82%

This table shows aggregate changes between 1995 and 2007 in inhouse production, domestic outsourcing, and offshoring. Variables are scaled by output and written in %. E.g., the upper-left elements mean that the share of inhouse production in output has changed from 49.83% in 1995 to 44.90% in 2007, which implies a decline by 10%. Note that the fourth component of total output (taxes, subsidies, and international transport margins) is not reported. Similarly, offshoring of primary inputs (NACE 1-14) and of some remaining services (NACE 80-95) are not reported.

In the manufacturing sector there is a clear linear bias in favour of more skilled labour. The highest growth rates of employment, hours worked, and wages are observed for high skilled labour and the lowest growth rates are observed for low skilled labour. In the service sector there is larger heterogeneity in the evolution of employment, hours worked and wages, but overall a distinctive pattern of polarisation in favour of high and low skilled labour. In terms of the number of employees the highest growth rate is observed for high skilled labour but the growth rate for low skilled labour is only slightly smaller. In terms of wages we even observe the highest growth rate for low skilled labour. Only in terms of hours worked we observe a different pattern. Here low skilled labour has the smallest growth rate.

Next, we document in table 3.3 stylized facts on the evolution of offshoring, domestic outsourcing, and inhouse production between 1995 and 2007. This is essentially a decomposition exercise as each variable is scaled by output. Any increase in offshoring is therefore, by construction, mirrored by a corresponding decrease in inhouse production or domestic outsourcing. This type of decomposition is useful because it reveals to which extent offshoring replaces inhouse production (we may call this "genuine offshoring") and to which extent offshoring replaces domestic outsourcing (this reflects supplier changes).[14]

[14] The importance of such a broad account of the changes in the organization of production has been highlighted in Winkler (2010), Castellani et al. (2013), and Schwörer (2013).

Columns 1-3 show aggregate trends between 1995 and 2007 including both the manufacturing and the service sector: inhouse production declined from about 50 to 45% of output which implies a decline by 5 percentage points (ppt) or 10%, domestic outsourcing declined by 1.3 ppt (-3%), and offshoring increased by 5.7 ppt (+78%). This suggests that Germany has experienced substantial relocations of inhouse production to foreign suppliers and – by a smaller scale – substitution of domestic suppliers by foreign suppliers. Furthermore, we observe that material offshoring accounts for a large part of total offshoring, though the growth rate is higher for service offshoring. Similarly, we observe that OECD countries represent the most important group of offshoring destinations, though the growth rates for Central and Eastern European countries, China, and the mostly low-wage "rest of the world" are considerably higher.

Columns 4-6 and 7-9 prove that the main aggregate pattern – reduced inhouse production and increased offshoring – applies also for the manufacturing sector and the service sector individually. However, we observe that the service sector offshores considerably less than the manufacturing sector (5.7% vs. 22.1% in 2007). During the sample period, offshoring increased in the service sector by 2.3 ppt and in the manufacturing sector by 9.1 ppt. This suggests that the scope for distributional effects of offshoring should be larger in the manufacturing sector.

From the summary statistics and the existing literature we condense several research questions that shall be addressed in the econometric analysis below: Can the observed increase in the relative demand for high skilled labour be explained by changes in offshoring or technologies? Does offshoring or technological change explain the differences in labour market trends between the manufacturing and the service sector, and in particular the trend towards polarisation in the service sector? Do offshoring destinations or the type of offshored inputs matter for these effects? Against the background of German labour market institutions: does the labour market adjust to offshoring through changes in relative wages or through changes in relative employment rates?

3.3 Empirical model

3.3.1 Derivation of the empirical model

We analyse these questions econometrically by estimating a system of three wage bill share equations, which we derive from an industry cost function augmented by offshoring.

Similar models have been used in the context of trade and offshoring by a large number of studies.[15] We proceed as follows. First, we briefly describe the most widely used empirical model in the literature. Second, we describe modifications of this benchmark model which have been used in studies on continental Europe to account for wage rigidities. Third, we show how variations of the benchmark model can be used to identify whether offshoring affects the relative demand for skills through changes in relative wages or relative employment.

We start with an arbitrary industry short-run cost function[16]

$$C(\mathbf{W},K,Y,\mathbf{Z}) = \min_{\mathbf{E}}(\mathbf{W}'\mathbf{E}) \quad \text{subject to} \quad Y = f(\mathbf{E},K,\mathbf{Z}) \tag{3.3}$$

where $\boldsymbol{W}$ is a vector of wages for high (H), medium (M), and low (L) skilled labour, and $\boldsymbol{E}$ is the corresponding vector of labour inputs. Industry and time subscripts are omitted to simplify notation. K denotes capital input, Y denotes output, and $\boldsymbol{Z}$ is a vector of shift factors that includes offshoring, domestic outsourcing and technological change. These shift factors may have two different types of effects. First, they can reduce the labour input requirements for the production of a given output (productivity effect). Second, they can change the cost efficient skill mix (distributional effect or factor bias effect). In this study we are interested in the latter type of effect.

The cost function can be approximated using the translog function[17]

$$\begin{aligned}\ln C(\mathbf{W},K,Y,\mathbf{Z}) =& \alpha + \sum_{s\in S}\beta_s \ln W_s + \frac{1}{2}\sum_{s\in S}\sum_{t\in S}\gamma_{st}\ln W_s \ln W_t + \beta_k \ln K + \gamma_{KK}\ln K^2 \\ &+ \beta_Y \ln Y + \gamma_{YY}\ln Y^2 + \sum_{p\in P}\beta_p Z_p + \frac{1}{2}\sum_{q\in Q}\gamma_{pq}Z_p Z_q + \sum_{s\in S}\gamma_{sK}\ln W_s \ln K \\ &+ \sum_{s\in S}\gamma_{sY}\ln W_s \ln Y + \sum_{s\in S}\sum_{p\in P}\gamma_{sp}Z_p \ln W_s + \gamma_{KY}\ln K \ln Y \\ &+ \sum_{p\in P}\gamma_{Kp}Z_p \ln K + \sum_{p\in P}\gamma_{Yp}Z_p \ln Y \end{aligned} \tag{3.4}$$

[15] This model was first proposed in the context of trade by Berman et al. (1994) and in the context of offshoring by Feenstra and Hanson (1996b). See Crinò (2009) for a review of the empirical literature.

[16] This cost function is a short-run cost function because we do not observe industry-specific capital prices and therefore assume that capital is quasi-fixed. The short-run costs are, thus, given by the industry's wage bill ($\mathbf{W}'\mathbf{E}^*$).

[17] The translog function is particularly suited because the functional form is highly flexible. According to Greene (2002) the translog cost function is the most popular specification in empirical work. Alternatives that have been used in the literature include the Leontief cost function (Morrison Paul and Siegel, 2001) and the Box-Cox cost function (Falk and Koebel, 2002).

where indices s and t represent skill levels and indices p and q represent shift variables. Differentiating with respect to the log wage of skill group s we obtain

$$\frac{\ln C}{\ln W_s} = \beta_s + \sum_{t \in S} \gamma_{st} \ln W_t + \gamma_{sK} \ln K + \gamma_{sY} \ln Y + \sum_{p \in P} \gamma_{sp} Z_p \tag{3.5}$$

Using Shephard's Lemma[18] it follows that the left hand side of equation 3.5 is the wage bill share (WSH) of skill group s:

$$\frac{\ln C}{\ln W_s} = \frac{\partial C/C}{\partial W_s/W_s} = \frac{\partial C}{\partial W_s}\frac{W_s}{C} = \frac{E_s^* W_s}{C} \equiv WSH_s \tag{3.6}$$

We obtain the following system of wage bill share equations:

$$WSH_H = \beta_H + \sum_{t \in S} \gamma_{Ht} \ln W_t + \gamma_{HK} \ln K + \gamma_{HY} \ln Y + \sum_{p \in P} \gamma_{Hp} Z_p C \tag{3.7}$$

$$WSH_M = \beta_M + \sum_{t \in S} \gamma_{Mt} \ln W_t + \gamma_{MK} \ln K + \gamma_{MY} \ln Y + \sum_{p \in P} \gamma_{Mp} Z_p C \tag{3.8}$$

$$WSH_L = \beta_L + \sum_{t \in S} \gamma_{Lt} \ln W_t + \gamma_{LK} \ln K + \gamma_{LY} \ln Y + \sum_{p \in P} \gamma_{Lp} Z_p C \tag{3.9}$$

Variants of this "benchmark model" have been estimated by a large number of studies (see Crinò 2009 for a survey). In the following we discuss a critical property of this model, which may likely cause an underestimation of the skill bias induced by offshoring or technological change: In equations 3.7 - 3.9 the offshoring coefficients capture the effects on the wage bill share of skill group s conditional on the wages of high, medium, and low skilled labour (and other covariates). Since the wage bill share is a function of wages and employment, the effect of offshoring on wages is completely absorbed by the wage controls and only the effects on relative employment is retained. We argue that this property is problematic because it entails an underestimation of the skill bias except for the unlikely case that wages are exogenous to changes in offshoring. In the more likely case at least some of the laid off workers are reabsorbed by the same industry at a lower wage. We therefore believe that the narrow focus on relative employment effects implied by the benchmark model is not well suited to capture the full effects of offshoring. This argument is of particular relevance for countries characterised by flexible wages, such as the US and UK. However, in light of the explicit evidence on wage effects due to offshoring (Geishecker and Görg, 2008; Baumgarten et al., 2013) the argument is also

[18] $\frac{\partial C}{\partial W_s} = E_s^*$, where E_s^* is the cost efficient labour input of skill group s.

likely to extend to continental Europe.[19]

Surprisingly, several studies on continental Europe use the alleged presence of wage rigidities to justify the choice of a different empirical model, which replaces the wage bill shares by employment shares.[20] Strauss-Kahn (2004), e.g., motivates this approach in the following way: "Although it could be argued that one should focus on the change in the relative wages [...], I believe that changes in employment shares is the more appropriate variable to analyze in considering the French case. Over the past three decades the French earnings dispersion between skilled and unskilled workers did not significantly rise, whereas France's employment share of skilled workers increased dramatically. This behavior of relative wages is common to most continental European countries and differs greatly from the U.K. and U.S. experience." Again, our major objection to this approach is that it assumes away rather than tests for potential effects on relative wages. Geishecker (2006) follows a different strategy. Using a C-Test he shows that wages can be treated as exogenous variables, which allows him to estimate the benchmark model without bias. However, given the functional relationship between wage bill shares and wages, the result of this exogeneity test seems questionable. Ekholm and Hakkala (2006) and Crinò (2012) use yet another strategy. Estimating wage bill share equations they exclude the wage regressors in a robustness check, and conclude that their previous results are robust to this exclusion.

In this study we proceed in a similar way as Ekholm and Hakkala (2006) and Crinò (2012). However, we interpret this not as a robustness check, but as a way to identify whether offshoring affects the labour market through changes in relative wage or through changes in relative employment: First, in our main specification we estimate a wage bill share equation that excludes wage regressors. Thereby we aim to capture the total effect of offshoring on the wage bill shares, capturing both the wage channel and the employment channel.[21] Second, we estimate a wage bill share equation that includes wage regressors. Thereby we aim to capture the effects of offshoring on the wage bill shares which operate through the employment channel.

[19] Recall also that this strand of the offshoring literature has emerged precisely because traditional trade theory failed to explain the growing wage inequalities. Thus, it seems inappropriate to estimate models which, by construction, cannot explain these effects either.

[20] See, for instance, Egger and Egger (2003), Strauss-Kahn (2004), Helg and Tajoli (2005), and in a robustness check Lorentowicz et al. (2008).

[21] See Feenstra and Hanson (1996b, 1999) on offshoring and Machin and van Reenen (1998) on technological change for similar estimations that exclude wage controls.

3.3.2 Econometric implementation

Several remarks on the econometric implementation are indicated at this point. First, we specify the variables in the estimation model as follows:

- Wage bill shares (*WSH*), logged wages by skill group (W_H, W_M, W_L), and logged output (Y) are directly obtained from the EUKLEMS database. Capital is measured as logged share of capital stock in output (*KInt*).

- Technological change is captured through two different variables: the share of research and development expenditures in total expenditures (*R&D*) and the share of investments in information and communication technologies in total investment (*ICT*).

- In the baseline specifications we use a broad offshoring measure (*OS*) that captures imports of all inputs (i.e. from NACE industries 15-74) and all countries. In later specifications we include separate measures for offshoring to Central and Eastern Europe, China, OECD, and the rest of the World; or separate measure for offshoring of material inputs and service inputs (see also section 3.2.1). All specifications also use a broad measure for domestic outsourcing (*DO*).

- Year fixed effects are included to account for changes in the relative supply of skills and other time-varying macroeconomic factors.

Second, to account for unobserved industry-specific time-variant factors that may be correlated with offshoring we use a fixed effects estimator. This implies that our inference is based on the variation of variables within sectors. Also, we account for clustering of standard errors within industries.

Third, endogeneity problems may arise either if variables, which are correlated with offshoring, are omitted from the regression (omitted variable bias) or if offshoring is endogenous due to simultaneity of the offshoring decision and the skill demand decision (simultaneity bias). We deal with the first issue by jointly controlling for two measures of technological change and by controlling for domestic outsourcing. Winkler (2010), Schwörer (2013), and Castellani et al. (2013) have shown that the latter is important in

order to avoid mixing up offshoring of inhouse production with changes in supplier structures.[22]

To deal with a possible simultaneity bias we apply instrumental variable estimations using current and lagged offshoring intensities of Austria and France as instruments for offshoring in Germany. We expect these instruments to be correlated with the endogenous regressor since trade and communication costs declined in all three countries in a similar way and also since their geographical location provides the countries with access to the same offshoring destinations. At the same time our instruments should be valid instruments if offshoring in Austria and France is unrelated to the relative demand for skills in Germany (other than through the correlation in offshoring). Arguably, there are factors which jointly affect offshoring in Austria and France and the demand for skills in Germany. For instance, it is reasonable to believe that the invention of the internet has increased the scope for offshoring around the globe and at the same time increased the relative demand for skilled labour in Germany. Thus, in order for our instruments to be valid we need to control for such factors. We believe that through the inclusion of two proxies for technological change and the inclusion of year fixed effects we are able to control for the most important sources of bias. We test for the reliability and validity of our instruments, as detailed in the section 3.4.

Four, we estimate the system of equations using seemingly unrelated regression (SUREG), which is a generalized least squares estimator. SUREG has been used in the same context by e.g. Hijzen et al. (2005), Ekholm and Hakkala (2006), and Crinò (2012). Different from equation-by-equation OLS, SUREG allows for correlation of the error terms across equations. According to Greene (2002) the coefficient estimates and standard errors from SUREG and equation-by-equation OLS are identical except a) if the equations have different sets of regressors or b) if parameter constraints are imposed. In our model the regressors are identical in the equations for high, medium, and low skilled labour. Still, SUREG is useful for our purposes because it allows us to test for differences in parameters across equations. Moreover, specific parameter constraints may be warranted in the model with wage controls to ensure that the estimated model satisfies the properties of the underlying cost function. For instance, symmetry requires $\gamma_{st} = \gamma_{ts}$ for all $t, s = [H, M, L]$.[23]

[22] Note that the following identity holds: offshoring + domestic outsourcing + inhouse production = 100%. Hence, if domestic outsourcing is controlled for in the regression, any increase in offshoring is mirrored by a decrease in inhouse production. In this way one can unambiguously identify whether offshoring of inhouse production changes the relative skill mix.

[23] This means, e.g., that an increase in the wage of high skilled labour affects the wage bill share of low skilled labour (γ_{HL}) in the same way as an increase in the wage of low skilled labour affects the wage bill

In robustness checks we impose these constraints on the wage coefficients (see section 3.4.3).

Note that only two of the three equations are linearly independent because the wage bill shares of high, medium, and low skilled labour sum to 1. Since SUREG is only feasible for linearly independent equations we have to drop one equation. The results are invariant to our choice of the equation to be dropped, precisely because in our case SUREG is equivalent to equation-by-equation OLS. This fact allows us to easily obtain the coefficients of *all* equations and to perform *all* cross-equation tests on differences in coefficients, by separately estimating SUREG for each pair of equations (i.e. we estimate SUREG three times).[24] Different than many previous studies we estimate SUREG by maximum likelihood rather than iterating Zellner's method, which allows us to estimate cluster-robust standard errors.[25] Maximum likelihood estimation is also helpful for the robustness check with imposed symmetry constraints, because it ensures that results are invariant to the choice of the equation to be dropped (Berndt, 1991, p. 473).

3.4 Econometric results

3.4.1 Baseline results

This section reports and discusses the econometric results. Table 3.4 shows the baseline results obtained from fixed effects (FE) seemingly unrelated regressions (SUREG) of the system of equations described in section 3.3.1. Dependent variables of the three equations are the wage bill shares of high, medium, and low skilled labour. The number of observations (364) is given by the number of industries (28) times the number of years (13). Time dummies are included but coefficients are not reported to save on space. Cluster-robust standard errors are reported in parantheses.

In specification (1) the system is estimated without wage controls. As discussed in section 3.3.1 we thereby aim to capture the total effect of offshoring on the wage bill shares,

share of high skilled labour (γ_{LH}).

[24] Alternatively, the coefficients and standard errors of the dropped equation could be calculated as a linear combination of the coefficients and standard errors of the directly estimated equations (Berndt, 1991).

[25] Maximum likelihood SUREG is estimated using the STATA ado file mysureg, downloadable from http://www.stata-press.com/data/ml2.html as part of the ml_ado package, and described in Gould et al. (2003).

capturing both the wage and employment channel. We observe that industry size, measured by industry output, is negatively linked with the wage bill share of high skilled workers and positively linked with the wage bill share of low skilled workers (statistically significant at the p=5% level). Capital intensity is not statistically significant in all three equations. This means that systematic complementarities between capital and particular skill groups are not observed.

Turning to the shift variables we observe that investment in information and communication technologies (ICT) is negatively associated with medium skilled labour (p=1%) and positively, though statistically insignificantly, associated with high and low skilled labour. The second proxy for technological change, research and development expenditures (R&D), is also negative for medium skilled labour (p=5%) and positive for low skilled labour (p=10%). If we consider the two technology variables jointly, then the estimates suggest that technological change contributes to a polarisation of labour demand in disfavour of medium skilled labour.

The coefficient of offshoring is positive but statistically insignificant for high skilled labour, positive but smaller for medium skilled labour (p=5%), and negative for low skilled labour (p=10%). Though the level of statistical significance is relatively low, these results are in line with the hypothesis that offshoring is biased in favour of higher skilled labour. Since the coefficient size increases in the skill level one may, at first sight, conclude that the skill bias applies for all parts of the skill distribution. We evaluate this aspect further below.

In specification (2) of table 3.4 wage bill shares are additionally regressed on wages. As discussed in section 3.3.1 we thereby aim to identify the effects of offshoring on the employment shares of single skill groups. In the following we highlight the main qualitative differences and similarities between the results from specifications (1) and (2). First, we observe that most of the wage regressors are highly significant. This is not surprising, given that the wage bill shares are by definition a function of wages. Second, we observe patterns of polarisation in labour demand as a consequence of technological change, similar to before. Third, the coefficient of offshoring is still negative for low skilled labour and positive for medium and high skilled labour. However, the coefficients are now much smaller and not statistically significant.

This is a remarkable fact which suggests that the skill bias induced by offshoring operates predominantly through changes in relative wages and less so through changes in relative employment. This is a novel finding which runs counter to the classical argument that,

Tab. 3.4: Baseline estimations (SUREG fixed effects model)

	(1)			(2)		
	High	Medium	Low	High	Medium	Low
Y	-0.0289***	0.0005	0.0284***	-0.0209***	0.0026	0.0183***
	(0.0085)	(0.0035)	(0.0079)	(0.0067)	(0.0047)	(0.0062)
KInt	-0.0127	-0.0009	0.0137	-0.0043	0.0049	-0.0006
	(0.0129)	(0.0072)	(0.0147)	(0.0102)	(0.0075)	(0.0126)
ICT	0.0622	-0.1227***	0.0605	0.0236	-0.1173***	0.0937***
	(0.0471)	(0.0410)	(0.0499)	(0.0424)	(0.0388)	(0.0325)
R&D	-0.5483	-0.4263**	0.9746*	0.6109	-0.8828***	0.2719
	(0.4246)	(0.2070)	(0.5143)	(0.3592)	(0.3151)	(0.3612)
OS	0.1360	0.0582**	-0.1942*	0.0543	0.0335	-0.0878
	(0.0842)	(0.0270)	(0.1031)	(0.0487)	(0.0296)	(0.0606)
DO	0.0136	0.0126	-0.0262	0.0047	0.0209	-0.0256
	(0.0554)	(0.0218)	(0.0607)	(0.0428)	(0.0220)	(0.0479)
W_H				0.1363***	-0.0630***	-0.0733***
				(0.0233)	(0.0210)	(0.0148)
W_M				-0.0930**	0.1265***	-0.0335
				(0.0376)	(0.0311)	(0.0277)
W_L				-0.0477**	-0.0615***	0.1092***
				(0.0222)	(0.0154)	(0.0229)
Observations	364	364	364	364	364	364
R-squared	0.8404	0.8813	0.4215	0.9032	0.9028	0.6843

SUREG fixed effects model. Dependent variable: wage bill shares of high, medium, and low skilled labour. Independent variables: log output (Y), log capital intensity (KInt), share of ICT investment in total investment (ICT), share of R&D expenditures in total expenditures (R&D), offshoring (OS), domestic outsourcing (DO), and log wages by skill group (W_H, W_M, W_L). Year dummies are included but coefficients not shown. Standard errors are clustered at the industry level. *** (**; *) denote significance at the one (five; ten) per cent level.

in Germany, wage rigidities imposed by labour unions prevent relative wages to adjust and thus cause unemployment among low skilled labour. Also, this finding suggests that previous studies may have underestimated the skill bias induced by offshoring. Many of the existing studies estimate either versions of specification (2) or employment share regressions, thus effectively only capturing the employment channel. In light of our results this seems to be too restrictive. Particularly in the Anglo-Saxon countries, where wages are allegedly more flexible than in Germany, such a narrow focus on employment effects seems hard to defend.

In table 3.5 we report results from t-tests on differences in parameters across skill groups based on the estimations from specification (1). The t-tests support the view that ICT investment is associated with a polarisation of labour demand. The difference in the coefficients of high and medium skilled labour is positive (coefficient=0.18, p=1%), the

difference in the coefficients of medium and low skilled labour is negative (coefficient=-0.18, p=5%), and the difference in the coefficient of high and low skilled labour is statistically insignificant. In terms of R&D expenditures we observe a statistically significant bias against medium skilled and in favour of low skilled labour. Jointly with the ICT coefficients this reinforces our interpretation that technological change is associated with polarisation in labour demand. In terms of offshoring we observe statistically significant differences between high and low skilled labour (coefficient=0.33, p=10%) and between medium and low skilled labour (coefficient=0.25, p=5%), but not between high and medium skilled labour (coefficient=0.07, insignificant). Hence, while offshoring is biased against low skilled labour we find no clear evidence of a bias against medium skilled labour, contrary to our first impression.

Tab. 3.5: T-tests of differences in coefficients across equations

	High - Low	High - Medium	Medium - Low
ICT	0.0017	0.1849***	-0.1832**
	(0.9841)	(0.0093)	(0.0163)
R&D	-1.5229*	-0.1220	-1.4009**
	(0.0896)	(0.7693)	(0.0292)
OS	0.3302*	0.0778	0.2524**
	(0.0689)	(0.2587)	(0.0383)
DO	-0.0398	0.0010	0.0388
	(0.7206)	(0.9852)	(0.5830)

T-tests of differences in coefficients across the three equations in table 3.4, specification (1). For instance, the upper left field shows that the ICT coefficient in the equation for high skilled labour is by 0.0017 larger than the same coefficient in the equation for low skilled labour. The corresponding p-value (in parenthesis) is 0.9841. Hence, we can reject the hypothesis that the two coefficients are different from each other at conventional levels of statistical significance.

In table 3.6 we show that our previous findings are qualitatively robust to the use of instrumental variable (IV) estimations. We use two stage least squares estimations and instrument for offshoring in the first stage using as instruments the current and past offshoring intensities for Austria and France. To establish whether instruments are reliable we conduct tests for underidentification and weak identification.[26] Underidentification is in all specifications rejected at the 10% level based on the Kleinbergen-Paap LM test. Weak identification is rejected based on the Kleinbergen-Paap Wald test. To establish whether instruments are valid we test whether overidentified instruments are uncorrelated with the

[26] Based on these tests we chose the current value and the first lag of offshoring in Austria as instruments for specification (3) and the current and first lag of offshoring in Austria and France as instruments in specification (4). The results also hold qualitatively if we use lagged German offshoring and domestic outsourcing as instruments for current German offshoring and domestic outsourcing. We prefer our main instruments, however, since uncorrelatedness with the error term is more likely to be satisfied.

Tab. 3.6: Instrumental variables estimations

	(3)			(4)		
	High	Medium	Low	High	Medium	Low
Y	-0.0229***	-0.0038	0.0266***	-0.0136**	-0.0016	0.0152**
	(0.0073)	(0.0028)	(0.0072)	(0.0056)	(0.0044)	(0.0061)
KInt	0.0014	-0.0096	0.0082	0.0001	-0.0006	0.0005
	(0.0161)	(0.0087)	(0.0153)	(0.0116)	(0.0087)	(0.0128)
ICT	0.0782*	-0.1140***	0.0358	0.0283	-0.1101***	0.0818***
	(0.0440)	(0.0387)	(0.0421)	(0.0381)	(0.0358)	(0.0266)
R&D	-0.4971	-0.5134**	1.0104*	0.7726**	-0.9429***	0.1703
	(0.5154)	(0.2345)	(0.5617)	(0.3875)	(0.3317)	(0.3537)
OS	0.2367**	-0.0212	-0.2155**	0.0581	-0.0061	-0.0520
	(0.1184)	(0.0568)	(0.1063)	(0.0704)	(0.0434)	(0.0629)
DO	0.0475	-0.0121	-0.0354	0.0061	0.0062	-0.0123
	(0.0553)	(0.0264)	(0.0564)	(0.0407)	(0.0246)	(0.0430)
W_H				0.1367***	-0.0647***	-0.0720***
				(0.0222)	(0.0200)	(0.0124)
W_M				-0.0951***	0.1285***	-0.0334
				(0.0346)	(0.0300)	(0.0247)
W_L				-0.0464**	-0.0612***	0.1076***
				(0.0188)	(0.0142)	(0.0203)
KP LM pval	0.0505	0.0505	0.0505	0.0531	0.0531	0.0531
KP Wald Fstat	10.71	10.71	10.71	21.26	21.26	21.26
Hansen J pval	0.708	0.387	0.702	0.266	0.294	0.975
Observations	336	336	336	336	336	336
R-squared	0.8325	0.8739	0.4213	0.9086	0.8974	0.7038

Instrumental variable fixed effects model. Instruments are the current and past offshoring intensities for Austria (specification 3) and for Austria and France (specification 4). Dependent variable: wage bill shares of high, medium, and low skilled labour. Independent variables: log output (Y), log capital intensity (KInt), share of ICT investment in total investment (ICT), share of R&D expenditures in total expenditures (R&D), offshoring (OS), domestic outsourcing (DO), and log wages by skill group (W_H, W_M, W_L). Year dummies are included but coefficients not shown. Standard errors are clustered at the industry level. *** (**; *) denote significance at the one (five; ten) per cent level.

error term using a Hansen J test. We cannot reject the hypothesis of valid instruments at the 10% level.

Notably, the IV estimations confirm that offshoring is skill-biased. Offshoring decreases the wage bill shares of low skilled labour and increases the wage bill shares of high skilled labour. The coefficient size and the statistical significance are even larger than before. An increase in offshoring by 1 percentage point is associated with a 0.24% increase in the wage bill share of high skilled labour and a a 0.22% decrease in the wage bill share of low skilled labour. Hence, according to simple back-of-the-envelope calculations, offshoring

accounts for 29% (or +1.4ppt) of the observed increase in the wage bill share of high skilled labour between 1995 and 2007 and for 135% (or -1.3ppt) of the observed decrease in the wage bill share of low skilled labour.[27] Yet, the coefficient of offshoring is small and statistically insignificant for medium skilled labour. By contrast, ICT investment and R&D expenditures can jointly explain 20% (or -0.8ppt) of the observed decline in the wage bill share of medium skilled labour, thus adding to the evidence that technological change causes a polarisation of labour demand.

3.4.2 Effects by offshoring destination, input type, and sector

In table 3.7 we analyse whether the previously identified effects depend on the destinations of offshoring or the type of offshored inputs, using SUREG estimations.[28] In specification (5) we distinguish between offshoring to OECD countries, Cental and Eastern European countries (CEEC), China, and the "rest of the world" (RoW) consisting predominantly of low-wage countries. The coefficients for CEEC and ROW are highly statistically significant and show clear patterns of skill biases. For the OECD and, surprisingly, China coefficients are not statistically significant. The coefficients for CEEC are particularly large, which suggests that the economic integration of CEEC into the European Union since the 1990s has entailed major distributional effects in Germany. An increase in offshoring to CEEC by 1 percentage point is associated with a 1.04% increase in the wage bill share of high skilled labour, a 0.39% increase for medium skilled labour, and a 1.44% decrease for low skilled labour.

In specification (6) we distinguish between two different types of inputs. Offshoring of material inputs (material offshoring) shows a pattern of skill bias which is qualitatively similar to the estimate for the broad offshoring measure and quantitatively larger. Offshoring of service inputs (service offshoring), by contrast, is not statistically significant. We note, however, that the size of the coefficients is reversed. This finding is in line with the hypothesis that high skilled labour is not shielded from offshoring when it comes to service activities such as accounting or IT services.

[27] The first number (+1.4) is obtained by multiplying the estimated coefficient (0.2367) by the observed average change in offshoring (+0.0598) and then dividing by the observed average change in the wage bill share of high skilled labour (+0.0487).

[28] We also estimated IV versions of these models. Using the first and second lag of offshoring and domestic outsourcing as instruments, results are similar to the reported SUREG estimates. Note however that our preferred instruments (offshoring in Austria and France) are not sufficiently correlated with offshoring in Germany in these specifications.

Tab. 3.7: Offshoring by destinations and types of inputs (SUREG fixed effects model)

	(5)			(6)		
	High	Medium	Low	High	Medium	Low
Y	-0.0218**	0.0031	0.0187**	-0.0234**	0.0034	0.0201**
	(0.0098)	(0.0039)	(0.0090)	(0.0093)	(0.0039)	(0.0089)
KInt	-0.0092	-0.0003	0.0095	-0.0232**	-0.0051	0.0282**
	(0.0131)	(0.0068)	(0.0139)	(0.0111)	(0.0050)	(0.0112)
ICT	0.0501	-0.1291***	0.0790*	0.0546	-0.1257***	0.0711
	(0.0408)	(0.0425)	(0.0444)	(0.0532)	(0.0387)	(0.0507)
R&D	0.4139	-0.0890	-0.3249	-0.0737	-0.1977	0.2714
	(0.4985)	(0.2253)	(0.5542)	(0.4213)	(0.1905)	(0.4716)
OS to OECD	0.1173	0.0150	-0.1323			
	(0.1122)	(0.0504)	(0.1217)			
...to CEEC	1.0490***	0.3919**	-1.4408***			
	(0.3111)	(0.1557)	(0.3557)			
...to China	0.2007	-0.0117	-0.1890			
	(0.2225)	(0.0899)	(0.2297)			
...to RoW	0.1305	0.0865***	-0.2170*			
	(0.1052)	(0.0262)	(0.1102)			
...of materials				0.2005*	0.0982**	-0.2987**
				(0.1144)	(0.0373)	(0.1321)
...of services				-0.2060	-0.1082	0.3142
				(0.2189)	(0.1144)	(0.2841)
DO	0.0090	0.0133	-0.0223	-0.0113	0.0033	0.0080
	(0.0525)	(0.0211)	(0.0513)	(0.0456)	(0.0205)	(0.0507)
Observations	364	364	364	364	364	364
R-squared	0.8567	0.8843	0.5602	0.8448	0.8834	0.4740

SUREG fixed effects model. Dependent variable: wage bill shares of high, medium, and low skilled labour. Independent variables: log output (Y), log capital intensity (KInt), share of ICT investment in total investment (ICT), share of R&D expenditures in total expenditures (R&D), domestic outsourcing (DO), and offshoring (OS) by destination or type of input. Year dummies are included but coefficients not shown. Standard errors are clustered at the industry level. *** (**; *) denote significance at the one (five; ten) per cent level.

We further explore the differences between materials and services in table 3.8. Here we allow for heterogeneous effects of offshoring and technological change in the manufacturing sector vis-à-vis the service sector by multiplying each shift variable with a service sector dummy. Note that, different from the previous estimations, this is not a distinction by type of offshored input but rather a distinction of offshoring effects by economic sectors.

Notably, we find that offshoring and ICT investment exert heterogeneous effects in the two sectors, where the effects for low skilled workers are always more benign in the service sector. First, we focus on offshoring. We observe a pattern consistent with skill bias

Tab. 3.8: Manufacturing and service sector (SUREG fixed effects model)

		(7)	
VARIABLES	High	Medium	Low
Y	-0.0242***	0.0060	0.0181***
	(0.0068)	(0.0040)	(0.0063)
KInt	-0.0138	0.0009	0.0129
	(0.0103)	(0.0071)	(0.0125)
ICT	0.0374	0.1419	-0.1793
	(0.1339)	(0.0976)	(0.1249)
R&D	-0.4165	-0.2481	0.6645*
	(0.3035)	(0.1788)	(0.3522)
OS	0.1061**	0.0651*	-0.1712***
	(0.0470)	(0.0362)	(0.0560)
DO	0.2020**	0.0920**	-0.2940**
	(0.0851)	(0.0437)	(0.1122)
SER * ICT	0.0511	-0.2712***	0.2200*
	(0.1349)	(0.0818)	(0.1282)
SER * R&D	2.8596*	-1.3637	-1.4959
	(1.4021)	(0.8148)	(1.2526)
SER * OS	-0.4506***	-0.1196**	0.5702***
	(0.0895)	(0.0556)	(0.1036)
SER * DO	-0.0510	-0.0461	0.0970
	(0.0794)	(0.0505)	(0.0759)
T-tests for the service sector			
Null hypotheses:		p-values	
ICT + SER * ICT = 0	0.0694*	0.0078***	0.3200
R&D + R&D * ICT = 0	0.0849*	0.0584*	0.4940
OS + SER * OS = 0	0.0546*	0.6530	0.0589*
DO + SER * DO = 0	0.4000	0.5150	0.2610
Observations	364	364	364
R-squared	0.8697	0.8904	0.6276

SUREG fixed effects model. Dependent variable: wage bill shares of high, medium, and low skilled labour. Independent variables: log output (Y), log capital intensity (KInt), share of ICT investment in total investment (ICT), share of R&D expenditures in total expenditures (R&D), domestic outsourcing (DO), and offshoring (OS). Shift variables are interacted with service sector dummy (SER). Year dummies are included but coefficients not shown. Standard errors are clustered at the industry level. *** (**; *) denote significance at the one (five; ten) per cent level.

in the manufacturing sector and the converse bias in the service sector. The total effect for the service sector (i.e. main effect + interaction effect) is positive for low skilled labour and negative for high and medium skilled labour. The t-tests at the bottom of the table show that the coefficients are statistically significant for high and low skiled labour (p=10%). Second, we focus on ICT investment. We observe an imprecisely estimated bias against low skilled labour in the manufacturing sector and a pattern broadly consistent

with polarisation in the service sector. In the service sector, ICT investment is negatively linked with the wage bill share for medium skilled labour (p=1%) and positively for high skilled labour (p=5%).

What is driving these sector differences? To answer this question we should first of all recall the results from specification (6) in table 3.7 which revealed a clear skill bias in material offshoring and the converse (though insignificant) bias in service offshoring. This aspect complements our findings on sector differences, suggesting that differences in the type of offshored inputs or activities matter. As highlighted in Blinder (2006, 2009) many skilled service sector jobs are easily "offshorable" due to the nature of the tasks that characterise these jobs. Blinder argues that offshorability in the service sector depends crucially on the requirement of physical presence (e.g. janitorial services) or face-to-face contact (e.g. taxi driving) and not primarily on skills. Moreover, Blinder and other authors have highlighted the close link between innovations in ICT and offshoring. ICT innovations dramatically expand the scope of offshorable activities. At the same time, ICT innovations often allow for an automation of tasks that were previously performed by, mostly, medium skilled labour. Several studies have therefore argued that technological change related to ICT may contribute to a polarisation in labour demand (Spitz-Oener, 2006; Acemoglu and Autor, 2011; Autor and Dorn, 2013). Our findings are consistent with these arguments.

3.4.3 Robustness checks

First, we check the robustness of one of our main results from section 3.4.1, where we found that offshoring affects the wage bill shares of high, medium, and low skilled labour mainly through changes in relative wages and less so through changes in relative employment. Recall that this finding runs counter to the widespread perception that German wage structures were rigid and largely exogenous to changes in offshoring.

To reassess this issue we estimate "employment share equations" using the shares of high, medium, and low skilled labour in total hours worked as dependent variables. In the literature similar models have been estimated either with excluded wage regressors (Strauss-Kahn, 2004; Helg and Tajoli, 2005; Lorentowicz et al., 2008), included wage regressors (Anderton and Brenton, 1999; Egger and Egger, 2003; Hijzen et al., 2005), or with both types of specifications (Machin and van Reenen, 1998; Ekholm and Hakkala, 2006). We note that the model with *excluded* wage regressors is not fully suitable to differentiate

Tab. 3.9: Employment share regressions (IV fixed effects model)

	(8)			(9)		
	High	Medium	Low	High	Medium	Low
Y	-0.0101*	-0.0160***	0.0262***	-0.0090*	-0.0129***	0.0219***
	(0.0053)	(0.0058)	(0.0059)	(0.0052)	(0.0049)	(0.0068)
KInt	-0.0039	-0.0003	0.0042	0.0013	-0.0085	0.0072
	(0.0111)	(0.0112)	(0.0141)	(0.0116)	(0.0077)	(0.0129)
ICT	-0.0048	-0.0776**	0.0824*	0.0082	-0.1137***	0.1055***
	(0.0379)	(0.0395)	(0.0439)	(0.0364)	(0.0315)	(0.0386)
R&D	1.1820***	-2.0259***	0.8440*	0.8133**	-1.1410***	0.3277
	(0.3161)	(0.5203)	(0.5106)	(0.3740)	(0.3548)	(0.4110)
OS	-0.0052	0.1449*	-0.1397	0.0419	-0.0081	-0.0338
	(0.0779)	(0.0857)	(0.0861)	(0.0676)	(0.0381)	(0.0611)
DO	-0.0152	0.0411	-0.0259	0.0052	-0.0044	-0.0008
	(0.0350)	(0.0365)	(0.0454)	(0.0390)	(0.0208)	(0.0395)
W_H				-0.0389**	0.0899***	-0.0510***
				(0.0193)	(0.0200)	(0.0149)
W_M				0.0417	-0.0682**	0.0264
				(0.0280)	(0.0308)	(0.0262)
W_L				-0.0073	-0.0200	0.0273
				(0.0161)	(0.0133)	(0.0204)
KP LM pval	0.0505	0.0505	0.0505	0.0531	0.0531	0.0531
KP Wald Fstat	10.71	10.71	10.71	21.26	21.26	21.26
Hansen J pval	0.218	0.405	0.958	0.284	0.109	0.942
Observations	336	336	336	336	336	336
R-squared	0.8322	0.7482	0.4498	0.8460	0.8217	0.5162

Instrumental variable fixed effects model. Instruments are the current and past offshoring intensities for Austria (specification 3) and for Austria and France (specification 4). Dependent variable: employment shares of high, medium, and low skilled labour, measured in terms of hours worked. Independent variables: log output (Y), log capital intensity (KInt), share of ICT investment in total investment (ICT), share of R&D expenditures in total expenditures (R&D), offshoring (OS), domestic outsourcing (DO), and log wages by skill group (W_H, W_M, W_L). Year dummies are included but coefficients not shown. Standard errors are clustered at the industry level. *** (**; *) denote significance at the one (five; ten) per cent level.

between wage and employment effects, because if offshoring actually affects wages then this model suffers from omitted variable bias. Still, we estimate both types of specifications, to make our results comparable with other studies. The results of our IV fixed effects estimations are display in table 3.9.[29]

In specification (8) of table 3.9 we observe that offshoring has no statistically significant effects on the employment shares of high skilled and low skilled labour, contrary to the

[29] Note that the first stage regressions of the employment share model are identical to the first stage regressions of the wage bill share model, reported in table 3.6. Hence, the tests for underidentification and weak identification are also identical.

Tab. 3.10: Constrained SUREG model

	(10)		
	High	Medium	Low
Y	-0.0217***	0.0029	0.0188***
	(0.0064)	(0.0039)	(0.0064)
KInt	-0.0044	0.005	-0.0006
	(0.0106)	(0.0071)	(0.0124)
ICT	0.0210	-0.1147***	0.0937***
	(0.0394)	(0.037)	(0.0312)
R&D	0.5716**	-0.9135***	0.3419
	(0.2837)	(0.2861)	(0.3146)
OS	0.0423	0.0408	-0.0831
	(0.0452)	(0.0272)	(0.0582)
DO	0.0007	0.0235	-0.0242
	(0.0418)	(0.0213)	(0.0458)
W_H	0.1264***	-0.0643***	-0.0621***
	(0.0179)	(0.0200)	(0.0125)
W_M	-0.0643***	0.1198***	-0.0555***
	(0.0200)	(0.0200)	(0.0143)
W_L	-0.0621***	-0.0555***	0.1176***
	(0.0125)	(0.0143)	(0.0181)
Constant	0.5565***	0.5820***	-0.1385
	(0.0891)	(0.0735)	(0.0861)
ε_{ss}	-0.2752	-0.1931	0.074
Obs	364	364	364

Constrained SUREG fixed effects model. Imposes symmetry and homogeneity of degree 1 in wages. Invariance to dropping of one equation is achieved through maximum likelihood estimation. Wage Dependent variable: wage bill shares of high, medium, and low skilled labour, measured in terms of hours worked. Independent variables: log output (Y), log capital intensity (KInt), share of ICT investment in total investment (ICT), share of R&D expenditures in total expenditures (R&D), offshoring (OS), domestic outsourcing (DO), and log wages by skill group (W_H, W_M, W_L). Year dummies are included but coefficients not shown. Standard errors are clustered at the industry level. *** (**; *) denote significance at the one (five; ten) per cent level. ε_{ss} is the own-wage elasticity of the demand for skill group *s*.

evidence from the wage bill share estimations (see table 3.6). Offshoring is positive and weakly statistically significant for medium skilled labour. Adding wage controls in specification (9) we observe that the sign of the offshoring coefficients is in line with skill bias, but all coefficients are small compared to the corresponding coefficients of the wage bill share regressions, and statistically insignificant. This supports our previous finding that offshoring affects the relative labour market outcomes of high, medium, and low skill labour predominantly through the wage channel and less so through the employment channel.

Second, economic theory implies certain restrictions on the wage parameters in order for the cost function to be well behaved (see Berndt, 1991, pp. 469ff). In particular,

symmetry implies: $\gamma_{st} = \gamma_{ts}\ \forall s,t \in S = [H,M,L]$. Moreover, homogeneity of degree 1 in wages implies: $\sum_{s\in S}\beta_s = 1$ and $\sum_s \gamma_{st} = \sum_s \gamma_{ts} = \sum_s \gamma_{sY} = 0$. As a robustness check we test for several of these restrictions using the baseline estimations in specification (2) of table 3.4. It turns out that the adding up conditions $\sum_s \gamma_{st} = 0$ hold in all equations, whereas symmetry only holds in two of three equations. We must reject the null hypothesis $\gamma_{ML} = \gamma_{LM}$ at the 10% level.

Too rule out that this affects our results, we re-estimate this model with imposed parameter restrictions. As pointed out in section 3.3.2 we estimate the SUREG model using maximum likelihood to ensure that our results are invariant to the choice of the equation to be dropped. The constrained estimations, displayed in table 3.10, qualitatively confirm our main results. The only notable change is that the coefficient of *R&D* in the equation for high skilled labour turns from insignificant to significant at the 5% level. We also calculate the own-price elasticities of factor demand at the mean of wage bill shares, which are given for the translog cost function by $\varepsilon_{ss} = \frac{\gamma_{ss}}{WSH_s} + WSH_s - 1$ (Berndt, 1991, p. 475). The own-price elasticities for high and medium skilled labour are negative, as expected. The own-price elasticities for low skilled labour is positive, violating economic theory. Thus, we note that the estimations with included wage regressors have to be interpreted with some caution.

3.5 Conclusion

The paper analyses the effects of offshoring on labour market inequalities between skill groups. Different from previous studies we address the question whether offshoring affects the labour market outcomes through changes in relative wages or through changes in relative employment. Also, we analyse whether offshoring can explain the diverging trends in the manufacturing and the service sector. Our analysis is based on data for 28 industries and three skill groups in Germany between 1995 and 2007. We derive our empirical model from an industry short-run cost function with three types of labour inputs (high, medium, and low skilled workers) which is augmented by offshoring, domestic outsourcing, and technological change. We estimate the resulting system of three wage bill share equations using seemingly unrelated regression and instrumental variable regressions.

Our main results are the following: We find that offshoring is on average over all industries biased in favour of high skilled labour and in disfavour of low skilled labour.

Offshoring can explain about 30% of the observed increase in the share of high skilled workers in the total wage bill and 135% of the observed decline in the share of low skilled workers, based on our instrumental variable estimates. These effects are mostly driven by offshoring to Central and Eastern European countries and by material offshoring.

Contrary to widely held believes we find that offshoring affects the labour market outcomes of the three skill groups mostly through changes in relative wages. This result runs counter to the argument that German labour market institutions (such as collective bargaining and unemployment benefits) prevent relative wages to adjust and thus cause unemployment among low skilled labour. Also, this finding suggests that previous studies may have underestimated the skill bias induced by offshoring.

While we find that offshoring is skill-biased in the manufacturing sector, we find the opposite direction of bias in the service sector. This finding is in line with the hypothesis that low skilled service workers are shielded from offshoring since their tasks are often physically bound to a domestic location (Blinder, 2006, 2009), but it is not in line with the hypothesis that offshoring causes polarisation in labour demand. However, unlike offshoring, technological change is associated with a polarisation in labour demand.

From our results we derive the following policy conclusions: First, to reduce the opposition to globalisation among parts of the society, policy makers should try to better explain the trade-off between welfare gains and distributional consequences of offshoring, and they should consider stronger redistributive policies which can be financed through achieved welfare gains. Second, our results for the service sector suggest that the consequences of offshoring are not only a matter of skills but also a matter of jobs or tasks. That calls for more research to identify how globalisation will in the long term affect the global division of labour and the nature of work in Germany. Policy makers should foster this process and adjust the education policies in order to best prepare the citizens for this future.

3.6 Bibliography

Abraham, Katharine G. and Susan Houseman, "Earnings Inequality in Germany," in Richard B. Freeman and Lawrence F. Katz, eds., *Differences and Changes in Wage Structures*, Chicago and London: The University of Chicago Press, 1995, pp. 371–404.

Acemoglu, Daron, "Cross-Country Inequality Trends," *The Economic Journal*, 2003, *113* (485), pp. F121–F149.

_ **and David H. Autor**, "Skills, Tasks and Technologies: Implications for Employment and Earnings," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, Vol. 4, Elsevier, 2011, chapter 12, pp. 1043–1171.

Amiti, Mary and Shang-Jin Wei, "Service Offshoring and Productivity: Evidence from the US," *World Economy*, 2009, *32* (2), 203–220.

Anderton, Bob and Paul Brenton, "Outsourcing and Low-Skilled Workers in the UK," *Bulletin of Economic Research*, 1999, *51* (4), 267–85.

Arndt, Sven W., "Globalization and The Open Economy," *The North American Journal of Economics and Finance*, 1997, *8* (1), 71–79.

Autor, David H. and David Dorn, "The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market," *American Economic Review*, 2013, *103* (5), 1553–97.

_ **, Frank Levy, and Richard J. Murnane**, "The Skill Content Of Recent Technological Change: An Empirical Exploration," *The Quarterly Journal of Economics*, November 2003, *118* (4), 1279–1333.

Baumgarten, Daniel, Ingo Geishecker, and Holger Görg, "Offshoring, Tasks, And The Skill-Wage Pattern," *European Economic Review*, 2013, *61* (C), 132–152.

Becker, Sascha O., Karolina Ekholm, and Marc-Andreas Muendler, "Offshoring and the Onshore Composition of Tasks and Skills," *Journal of International Economics*, 2013, *90* (1), 91–106.

Berman, Eli, John Bound, and Zvi Griliches, "Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufacturers," *The Quarterly Journal of Economics*, 1994, *109* (2), 367–397.

Berndt, Ernst R., *The Practice of Econometrics: Classic And Contemporary*, Reading, Mass.: Addison-Wesley, 1991.

Blinder, Alan S., "Offshoring: The Next Industrial Revolution?," *Foreign Affairs*, 2006, *85* (2), 113–128.

_ , "How Many US Jobs Might Be Offshorable?," *World Economics*, April 2009, *10* (2), 41–78.

Card, David, Jörg Heining, and Patrick Kline, "Workplace Heterogeneity and the Rise of West German Wage Inequality," *The Quarterly Journal of Economics*, 2013, *128* (3), 967–1015.

Castellani, Davide, Luca de Benedictis, and Daniel Horgos, "Can We Really Trust Offshoring Indices?," *Structural Change and Economic Dynamics*, 2013, *25* (C), 159–172.

Crinò, Rosario, "Offshoring, Multinationals And Labour Market: A Review Of The Empirical Literature," *Journal of Economic Surveys*, 2009, *23* (2), 197–249.

_ , "Service Offshoring and White-Collar Employment," *Review of Economic Studies*, 2010, *77* (2), 595–632.

_ , "Service Offshoring and the Skill Composition of Labour Demand," *Oxford Bulletin of Economics and Statistics*, 2012, *74* (1), 20–57.

Deardorff, Alan V., "Fragmentation in Simple Trade Models," *The North American Journal of Economics and Finance*, 2001, *12* (2), 121–137.

Dustmann, Christian, Johannes Ludsteck, and Uta Schönberg, "Revisiting the German Wage Structure," *The Quarterly Journal of Economics*, 2009, *124* (2), 843–881.

Egger, Hartmut and Peter Egger, "Outsourcing And Skill-Specific Employment in A Small Economy: Austria after The Fall of The Iron Curtain," *Oxford Economic Papers*, 2003, *55* (4), 625–643.

_ **and** _ , "Labor Market Effects uf Outsourcing under Industrial Interdependence," *International Review of Economics & Finance*, 2005, *14* (3), 349–363.

_ **and** _ , "International Outsourcing and the Productivity of Low-Skilled Labor in the EU," *Economic Inquiry*, 2006, *44* (1), 98–108.

Ekholm, Karolina and Katariina Hakkala, "The Effect of Offshoring on Labour Demand: Evidence from Sweden," CEPR Discussion Papers 5648, CEPR 2006.

Falk, Martin and Bertrand M. Koebel, "Outsourcing, Imports and Labour Demand," *Scandinavian Journal of Economics*, 2002, *104* (4), 567–86.

Feenstra, Robert C. and Gordon H. Hanson, "Foreign Investment, Outsourcing and Relative Wages," in Robert C. Feenstra, Gene M. Grossman, and Douglas A. Irwin, eds., *The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati*, Vol. 1 of *MIT Press Books*, The MIT Press, 1996.

_ **and** _ , "Globalization, Outsourcing, and Wage Inequality," *American Economic Review*, 1996, *86* (2), 240–45.

_ **and** _ , "The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990," *The Quarterly Journal of Economics*, 1999, *114* (3), 907–940.

_ **and J. Bradford Jensen**, "Evaluating Estimates of Materials Offshoring from US Manufacturing," *Economics Letters*, 2012, *117* (1), 170–173.

Fitzenberger, Bernd, *Wages and Employment Across Skill Groups. An Analysis for West Germany* , ZEW Economic Studies, 6, Physica, 1999.

Freeman, Richard B. and Lawrence F. Katz, "Introduction and Summary," in "Differences and Changes in Wage Structures," The University of Chicago Press, Chicago: National Bureau of Economic Research, 1995, pp. 1–22.

_ **and Ronald Schettkat**, "Skill Compression, Wage Differentials, and Employment: Germany vs the US," *Oxford Economic Papers*, 2001, *53* (3), 582–603.

Geishecker, Ingo, "Does Outsourcing to Central and Eastern Europe Really Threaten Manual Workers' Jobs in Germany?," *The World Economy*, 2006, *29* (5), 559–583.

_ **and Holger Görg**, "Winners and Losers: A Micro-Level Analysis of International Outsourcing and Wages," *Canadian Journal of Economics*, 2008, *41* (1), 243–270.

_ **and** _ , "Services Offshoring and Wages: Evidence from Micro Data," *Oxford Economic Papers*, 2013, *65* (1), 124–146.

Goos, Maarten, Alan Manning, and Anna Salomons, "Job Polarization in Europe," *The American Economic Review*, 2009, *99* (2), 58–63.

Gottschalk, Peter and Timothy M. Smeeding, "Cross-National Comparisons of Earnings and Income Inequality," *Journal of Economic Literature*, 1997, *35* (2), 633–687.

Gould, William, Jeffrey Pitblado, and William Sribney, *Maximum Likelihood Estimation with STATA*, College Station, Tex.: Stata Press, 2003.

Greene, Wiliam H., *Econometric Analysis*, 5 ed., London: Prentice Hall, 2002.

Görg, Holger and Aoife Hanley, "International Outsourcing and Productivity: Evidence from the Irish Electronics Industry," *The North American Journal of Economics and Finance*, 2005, *16* (2), 255–269.

_ , _ , and Eric Strobl, "Productivity Effects of International Outsourcing: Evidence from Plant-Level Data," *Canadian Journal of Economics*, 2008, *41* (2), 670–688.

Grossman, Gene M. and Esteban Rossi-Hansberg, "Trading Tasks: A Simple Theory of Offshoring," *American Economic Review*, 2008, *98* (5), 1978–97.

Helg, Rodolfo and Lucia Tajoli, "Patterns of International Fragmentation of Production and the Relative Demand for Labor," *The North American Journal of Economics and Finance*, 2005, *16* (2), 233–254.

Hijzen, Alexander, Holger Görg, and Robert C. Hine, "International Outsourcing and the Skill Structure of Labour Demand in the United Kingdom," *Economic Journal*, 2005, *115* (506), 860–878.

Jones, Ronald W. and Henryk Kierzkowski, "A Framework for Fragmentation," in Sven W. Arndt and Henryk Kierzkowski, eds., *Fragmentation: New Production Patterns in the World Economy*, Oxford: Oxford University Press, 2001.

Katz, Lawrence F. and David H. Autor, "Changes in the Wage Structure and Earnings Inequality," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics*, Vol. 3 of *Handbook of Labor Economics*, Elsevier, 1999, chapter 26, pp. 1463–1555.

Kohler, Wilhelm, "A Specific-Factors View on Outsourcing," *The North American Journal of Economics and Finance*, 2001, *12* (1), 31–53.

_ , "International Outsourcing and Factor Prices with Multistage Production," *Economic Journal*, 2004, *114* (494), C166–C185.

Krugman, Paul, "Past and Prospective Causes of High Unemployment," *Economic review (Federal Reserve Bank of Kansas City)*, 1994, pp. 49–98.

Leamer, Edward E. and Michael Storper, "The Economic Geography of the Internet Age," *Journal of International Business Studies*, 2001, *32* (4), 641–665.

Lorentowicz, Andzelika, Dalia Marin, and Alexander Raubold, "Is Human Capital Losing from Outsourcing?: Evidence for Austria And Poland," in Steven Brakman and Harry Garretsen, eds., *Foreign Direct Investment and The Multinational Enterprise*, Cambridge, Mass.: MIT Press, 2008.

Machin, Stephen and John van Reenen, "Technology and Changes in Skill Structure: Evidence from Seven OECD Countries," *The Quarterly Journal of Economics*, 1998, *113* (4), 1215–1244.

Minondo, Asier and Gloria Rubert, "The Effect of Outsourcing on The Demand for Skills In The Spanish Manufacturing Industry," *Applied Economics Letters*, 2006, *13* (9), 599–604.

Morrison Paul, Catherine J. and Donald S. Siegel, "The Impacts of Technology, Trade and Outsourcing on Employment and Labor Composition," *Scandinavian Journal of Economics*, 2001, *103* (2), 241–64.

Nickell, Stephen and Brian Bell, "Changes in the Distribution of Wages and Unemployment in OECD Countries," *American Economic Review*, 1996, *86* (2), 302–08.

OECD, *Divided We Stand: Why Inequality Keeps Rising*, OECD Publishing, 2011.

Prasad, Eswar S., "The Unbearable Stability of the German Wage Structure: Evidence and Interpretation," *IMF Staff Papers*, 2004, *51* (2), 354–385.

Puzzello, Laura, "A Proportionality Assumption and Measurement Biases in the Factor Content of Trade," *Journal of International Economics*, 2012, *87* (1), 105–111.

Schöller, Deborah, "Service Offshoring and the Demand for Less-Skilled Labor: Evidence from Germany," Hohenheimer Diskussionsbeiträge 287, University of Hohenheim 2007.

Schwörer, Tillmann, "Offshoring, Domestic Outsourcing and Productivity: Evidence for a Number of European Countries," *Review of World Economics*, 2013, *149* (1), 131–149.

Spitz-Oener, Alexandra, "Technical Change, Job Tasks, and Rising Educational Demands: Looking Outside the Wage Structure," *Journal of Labor Economics*, 2006, *24* (2), 235–270.

Strauss-Kahn, Vanessa, "The Role of Globalization in the Within-Industry Shift Away from Unskilled Workers in France," in "Challenges to Globalization: Analyzing the Economics," National Bureau of Economic Research, 2004, pp. 209–234.

Timmer, Marcel et al., "The World Input-Output Database (WIOD): Contents, Sources and Methods," Working Paper 10, WIOD 2012.

Venables, Anthony J., "Fragmentation and Multinational Production," *European Economic Review*, 1999, *43* (4-6), 935–945.

Winkler, Deborah, "Services Offshoring and its Impact on Productivity and Employment: Evidence from Germany, 1995–2006," *The World Economy*, 2010, *33* (12), 1672–1701.

_ **and William Milberg**, "Errors from the "Proportionality Assumption" in the Measurement of Offshoring: Application to German Labor Demand," Working Paper 12, Schwartz Center for Economic Policy Analysis and New School for Social Research 2009.

Part II

NGOS

4. US BASED NGOS IN INTERNATIONAL DEVELOPMENT: FINANCIAL AND ECONOMIC DETERMINANTS OF SURVIVAL

4.1 Introduction

Non-governmental organizations (NGOs) play a major role in international development activities, particularly for foreign aid from the United States (McCleary and Barro, 2008). NGOs are widely regarded as the preferred channel of aid delivery, at least partly substituting for the state (e.g., Hulme and Michael, 1997; McCoskey, 2009). Nevertheless, NGOs cannot take it for granted that they survive in the foreign aid "market". Claims that NGO aid is superior to official aid "are often inaccurate" (Edwards and Hulme, 1996, p. 693). The reputation of NGOs has suffered from scandals and declining public trust (Ebrahim, 2003; Gugerty, 2009; Prakash and Gugerty, 2010a). Their legitimacy and accountability is questioned, not least because of the considerable funding of NGOs by official donors (Edwards and Hulme, 1996; Prakash and Gugerty, 2010b). As stressed by Moulton and Eckerd (2012, p. 664), NGOs are dependent on their external environment, notably the resource environment, for legitimacy and survival.

In public opinion polls, about half of American respondents state that they focus on how much NGOs spend on administration and fundraising when deciding on donations (Nonprofit Overhead Cost Project, 2004b). By contrast, NGO managers and staff appear to be confident that reputation, mission and impact on the ground are much more important than financial ratings (Szper and Prakash, 2011). This invites the question of whether NGO survival depends mainly on efficiency in financial terms or effectiveness in terms of impact. Resource dependency can be expected to have a major say in this context. External resources, including public funding, are likely to shape the behavior and strategy of NGOs (Moulton and Eckerd, 2012), while the adoption of particular performance evaluations may differ depending on the perceptions of major external financiers (Eckerd and Moulton, 2011).

As noted by Brakman Reiser (2010, p. 48), effectiveness or accountability related to the NGOs' mission is "very difficult to measure or track". Hence, our empirical estimations are restricted to financial and economic factors that can be quantified for a large sample of NGOs.[1] We focus on the impact of administrative overheads, public funding and the interaction between these two factors on the survival probability of NGOs. We control for more standard determinants such as the size and experience of NGOs. When developing our hypotheses (section 4.2) and interpreting our empirical results (section 4.4), we also take into account that the survival probability of NGOs is likely to depend on a broader set of factors which are difficult to quantify. Public perceptions, commonly accepted norms in the development community and self-regulation among NGOs may weaken, or even reverse the impact of narrowly defined financial and economic factors.

It is thus open to question whether less efficient NGOs are more likely to exit the foreign aid market than their more efficient peers.[2] The efficiency price of aid – i.e., the relative importance of expenses that are not directly associated with charitable activity and overseas aid projects – varies widely among NGOs. For instance, the share of expenses for administration and management ranges from zero to about half of the overall budget within the sample of US based NGOs used by Nunnenkamp and Öhler (2012a).

Assessing the role of efficiency for NGO survival is relevant for the NGOs themselves, the aid receiving countries, and the private and official financiers of NGOs – even though more efficient NGOs are not necessarily superior in terms of impact and other aspects of accountability may overrule financial criteria. The exit threat is clearly relevant for the NGO themselves as it might reduce or even prevent so-called perquisite consumption. Unless NGO staff is purely altruistic, it may be tempted to divert part of the funds away from overseas aid projects to headquarter facilities, travel and similar perks. The exit threat could strengthen the so-called non-distribution constraint according to which NGOs are not allowed to generate profits and disburse them to owners, managers and staff (Hansmann, 1980).[3] The aid recipients are interested in higher and sustained project-related spending on the ground. The predictable amount of project financing could be higher if

[1] Using the terminology referred to by Ebrahim (2003, p. 815), we focus on important aspects of NGOs' functional accountability (notably, accounting for the use of resources), rather than strategic accountability (with regard to the impact NGOs have on other organizations and the wider environment).

[2] Note that we use the term 'efficiency' throughout the paper in the narrow economic sense of the efficiency price of NGO aid, which is commonly defined as "reciprocal of the share of service expenditures (total expenditures less fund-raising and administrative expenses) in total expenditures" (Ribar and Wilhelm, 2002, p. 400). See also Khanna and Sandler (2000) who use the term "price of giving."

[3] See section 4.2.1 below for a detailed discussion of the non-distribution constraint.

more efficient NGOs survived, while less efficient NGOs left the market.[4]

For private donors who dislike NGOs spending heavily on administration and fundraising it would be reassuring to know that relatively inefficient NGOs were squeezed out of the market even if individual donors do not engage in systematic screening of various NGOs.[5] Compared to private donors, official aid agencies should find it easier to screen the NGOs and allocate funding accordingly. Hence, we hypothesize that efficiency becomes more important for the survival of NGOs once they accept public funding and scrutiny. It cannot be ruled out, however, that public funding weakens the link between NGO efficiency and market exit by relaxing budget constraints if NGOs anticipate that waste will not be effectively sanctioned by state authorities due to bureaucratic slack.

Data on the expenditure and revenue patterns of NGOs engaged in international development cooperation are notoriously scarce. This applies all the more so when sufficiently long time series are required to assess the sustainability of NGO operations. The database on US NGOs compiled by Rachel McCleary provides a major exception, however. This database covers almost 900 NGOs for the 1984-2005 period under consideration here. Moreover, we updated this database for more recent years in order to test for the robustness of our baseline estimations (see section 4.4.2 for details). We employ these data in probit estimations to assess whether NGOs with a higher efficiency price of aid are more likely to discontinue international development cooperation than more efficient peers. Furthermore, by interacting the efficiency price of aid with funding from official sources we address the question of whether the survival probability of inefficient NGOs depends on public funding. We control for several aspects of NGO heterogeneity, including the size and age as well as the main activity and religious affiliation of NGOs. In addition to NGO-specific characteristics, we consider "market" characteristics such as the density and concentration of NGO operations.

Section 4.2 portrays the analytical background and specifies the hypotheses. In section 4.3, we describe the data and introduce our estimation strategy. Empirical results are presented in section 4.4. We conclude in section 4.5.

[4] Arguably, aid recipients may prefer the survival of both efficient and inefficient NGOs. Overall resources for development may decline if surviving NGOs do not attract the private donations and public funding previously absorbed by exiting NGOs. While we do not capture the redirection of funding to surviving NGOs in the present paper, we show in section 4.3 that exit probabilities reach 8-11 per cent in some subgroups of NGOs.

[5] Nunnenkamp and Öhler (2012b) find that donors hardly make use of publicly available information on NGO characteristics, notably the 'price of giving' and the degree of specialization, when deciding on donations.

4.2 Analytical background and hypotheses

4.2.1 Different mechanisms of NGO accountability

NGO accountability can be defined as the means by which NGOs "report to a recognized authority (or authorities) and are held responsible for their actions" (Edwards and Hulme, 1996, p.967). According to Ebrahim (2005, p.59), the concept should be broadened to include both being held responsible by external principals (the external dimension of accountability) and taking responsibility for oneself (the internal dimension of accountability).[6] Fowler (1995) argues that growing external and internal pressures reveal serious inadequacies in past attempts to assess NGO performance and accountability. In contrast to governments and businesses which can be assessed in terms of political support and financial returns, there is no universally accepted "bottom line" for assessing NGOs (Fowler, 1995) .

Our subsequent empirical analysis clearly falls short of capturing broad concepts of NGO accountability. Public funding represents an important element of the external resource environment that shapes the NGOs' behavior (Moulton and Eckerd, 2012) and creates pressure for conformity in terms of accountability and evaluation practices (Eckerd and Moulton, 2011). But our empirical analysis misses various other elements of the external environment: "Viewing the environment as solely consisting of funders is limiting. Neo-institutional theory suggests that there are strong mimetic pressures on organizations to follow similar processes to other organizations in their environment" (Eckerd and Moulton, 2011, p. 104). Furthermore, given the diversity of NGOs, Eckerd and Moulton (2011) question the usefulness of "across the board" evaluation tools. They show that institutional perceptions prevailing in the external environment, including among financiers, tend to predict the adoption of particular performance evaluations, while heterogeneous roles of NGOs tend to predict the actual uses of evaluations.[7] Keeping these limitations in mind, various arguments advanced in the relevant literature may prove useful in developing and qualifying our central hypotheses and may also help interpret our estimation

[6] In a similar vein, Edwards and Hulme (1996) distinguish between upward accountability to trustees, donors and host governments and downward accountability to partners, beneficiaries, staff and supporters. See also Jordan (2005), Jordan and van Tuijl (2007), and Ebrahim (2010) on the question of "acountability to whom."

[7] We tentatively account for heterogeneity within our sample of internationally active NGOs by including NGO-type-specific fixed effects in our estimations (see section 4.3.4 for details). However, this clearly falls short of distinguishing between major role models as suggested by Eckerd and Moulton (2011) and Moulton and Eckerd (2012)

results.

Jordan and van Tuijl (2007) portray major shifts in the perception of NGO accountability over time. The earlier literature often referred to the so-called non-distribution constraint as the central common trait of NGOs that might help contain information asymmetries and related concerns about NGO accountability.[8] Hansmann (1980) introduced the non-distribution constraint as an institutional feature that could create public trust in NGOs. By prohibiting NGOs to distribute any profits to owners, managers and staff exercising control over the organization, the donors and "consumers" of NGO output would be assured about the NGOs' good intensions and protected against opportunistic behavior, e.g., in terms of exploiting information asymmetries and lowering the quality of output. However, subsequent research has increasingly questioned the effectiveness of the non-distribution constraint in preventing opportunistic NGO behavior and creating public trust. For instance, this institutional feature alone does not rule out opportunistic behavior as NGO insiders may benefit from "perquisites" such as lower effort, higher pay, better offices, or generous travel allowances (Glaeser and Shleifer, 2001).[9] Gugerty (2009, p. 246) concludes that the disciplining power of the non-distribution constraint is "potentially weak."

Compared to the specific concept of the non-distribution constraint, the literature on the "new institutionalism" has suggested a broader set of both formal and informal mechanisms that may constrain NGO behavior and improve accountability.[10] DiMaggio (1998) distinguishes between different strands of this literature, stressing (i) rational behavior and formal rules of the game (notably laws), (ii) state intervention and mediation, or (iii) informal, socially constructed and normative factors. Most interestingly in the present context, proponents of strand (iii) emphasize that pressures to appear legitimate, accepted normative schemes as well as commonly applied standards in a profession could result in organizational behavior that is "less efficient than rejected alternatives" (DiMaggio, 1998, p. 697). In a similar vein, DiMaggio and Powell (1983) argue that normatively sanctioned strategies tend to be adopted even if they may not be rational when adopted by large numbers of organizations.[11] More recently, Bloodgood and Tremblay-Boire (2011) observes

[8] Agency and monitoring problems are rooted in the nature of NGOs' output the quality of which is difficult to verify for principals and beneficiaries (Prakash and Gugerty, 2010a).

[9] For an overview on arguments against the binding character of non-distribution constraints, see Prakash and Gugerty (2010b, pp. 283-286). See also Prakash and Gugerty (2010a).

[10] For an earlier overview of the new institutionalism in organizational analysis, see the contributions in Powell and DiMaggio (1991).

[11] See also Strang and Meyer (1993, p. 491) who argue that organizational behavior diffuses via perceptions built into the actors involved: "The individual or organization's cognitive map identifies reference

that NGOs may be increasingly constrained by social norms to which they must abide in order to be seen as legitimate, even though this behavior is not necessarily the most efficient one. According to Bloodgood and Clough (2010), conforming to social norms may be as important as organizational efficiency to guarantee NGO survival.[12]

However, social expectations and normative pressure per se may involve only weak constraints on NGO behavior unless "the nonprofit sector is sufficiently institutionalized for such pressures to operate" (Gugerty, 2009, p. 250). The design of institutions for tightening behavioral constraints and strengthening accountability has received a lot of attention recently, notably with regard to self-regulation among NGOs.[13] Collective action by forming voluntary accountability clubs can help address information asymmetries between NGOs and their stakeholders. Club membership is expected to signal the quality and reliability of NGOs (Gugerty, 2009; Prakash and Gugerty, 2010b,a). Clearly, the effectiveness of self-regulation depends on the strength of standards agreed among club members as well as the mechanisms to enforce compliance within the club. As noted by Ebrahim (2003, 2010), self-regulation among NGO is a fairly recent phenomenon and the content of codes and standards varies considerably. For instance, InterAction, a membership organization of US based NGOs engaged in international development, developed a set of standards in 1993; InterAction's Self-Certification Plus, an initiative of 2001, has been rated as medium strict in terms of the content of standards, while verification is missing (Gugerty, 2009, p. 268).[14]

Self-regulation is often meant to preempt stricter government regulation (Gugerty, 2009, p. 245; Ebrahim, 2010, p. 15). Drawing on DiMaggio and Powell's 1983 terminology, normative pressure within the NGO community may be preferred over coercive pressure from outside the community as a mechanism to achieve compliant organizational behavior. The actual role of government regulation as an alternative mechanism to constrain NGO behavior is open to debate. Bloodgood et al. (2010) find that governments in pluralist countries typically have a permissive regulatory style with regard to NGOs. This applies to the United States, for example, which imposes "relatively few restraints" on

groups that bound social comparison processes."

[12] Ebrahim (2005, p. 64) differentiates between organizations whose output is relatively easy to measure and organizations whose goals are more process oriented. In particular the latter type "may be better assessed by an institutional-theory model, that is, by measuring their conformity to what society expects of them."

[13] For a recent overview on self-regulation among NGOs, see the contributions to the volume edited by Gugerty and Prakash (2010).

[14] See Gugerty (2009) for a detailed assessment of compliance standards and verification mechanisms for a sample of 32 nonprofit accountability programs.

NGOs (page 23).[15] On the other hand, Edwards and Hulme (1996) argue that accepting increasing amounts of public funding implies "upward accountability" in the sense that NGOs have to comply with government regulation on what is done and how it is to be accounted for. Jordan and van Tuijl (2007) discuss various tactics used by governments to interfere with NGO activities.

The dependence of various NGOs on public funding implies that the relationships among NGOs are often characterized by competition rather than cooperation (Gugerty, 2009, p. 250). Cooley and Ron (2002) provide detailed case studies of the scramble among NGOs for renewable and, typically, short-term contracts offered by official financiers. The "marketization of aid funding" pushes NGOs towards greater competition. Cooley and Ron are concerned about the disincentive effects of the marketization on the development orientation of NGOs and their willingness to cooperate. Likewise, Edwards and Hulme (1996, p. 966) argue that the competition among NGOs for public funding bodes ill for collaboration and successful policy alliances. At the same time, the reasoning of Edwards and Hulme (1996) and Cooley and Ron (2002) is clearly relevant in the context of our analysis which focuses on the possible interrelations between public funding, NGOs' administrative overhead and NGO survival probability. More specifically, these interrelations might be expected to determine primarily the survival of competing NGOs with relatively strong "upward" and "functional" accountability (Ebrahim, 2003). It is mainly for these NGOs that "unit costs, quantifiable outputs, logical frameworks and detailed specifications of what 'partners' are to do, [might] become organizational norms" (Hulme and Michael, 1997, p. 8). According to Cooley and Ron (2002, p. 11f), official financiers "seek to fund projects, not administrative overhead, hoping that this will push INGO contractors to rationalize procedures, demonstrate effectiveness, and slash overhead."

In particular US authorities "focus their enforcement efforts squarely on financial accountability concerns" (Brakman Reiser, 2010, p. 43). Section 501(c) of the Internal Revenue Code (IRC) is the primary source of national NGO regulation in the United States (Bloodgood et al., 2010). To be exempted from federal taxes NGOs have to provide detailed information, notably on finances and program, in so-called Form 990 (Ebrahim, 2003, p. 816). NGOs that register with USAID may "not expend more than 40 per cent of total expenses on supporting services."[16] However, not only state authorities focus on financial

[15] Moreover, Bloodgood (2011) find that the War on Terror has not resulted in considerably stricter regulations. For a more skeptical assessment, see Jordan and van Tuijl (2007).

[16] For USAID conditions of registration, see: http://idea.usaid.gov/sites/default/files/attachments/conditions_us_organizations.pdf (accessed: July 2012).

accountability of NGOs. Traditionally, the same applied to the rating of US-based NGOs by watchdogs such as Charity Navigator (Szper and Prakash, 2011, appendix 1).[17]

The focus on financial accountability has been criticized on conceptual and practical grounds. Critics, including Ebrahim (2003, 2010) and Szper and Prakash (2011) argue that financial indicators provide at best limited information on the quality of NGO operations on the ground. Specifically, the pressure to reduce overhead expenditure below a threshold may be counterproductive, with the optimum being difficult to determine.[18] However, the critique of narrow concepts of NGO accountability does not necessarily imply that NGO efficiency and its interrelation with public funding are no longer relevant for the survival of NGOs, which is the issue addressed in the following.

4.2.2 Central hypotheses and control variables

To the best of our knowledge, the present study is the first to provide an empirical assessment of the links between the efficiency price of aid, public funding and the survival of NGOs in international development. However, our analysis clearly relates to well-developed strands of the literature. While our empirical analysis cannot capture broad concepts of accountability, we develop our central hypotheses by drawing on the literature summarized in the previous section. At the same time, we draw on the theoretical and empirical insights from the rich literature on the determinants of exit and survival in industries dominated by profit-oriented firms.

As concerns the latter strand of the literature, the model of industry dynamics presented by Jovanovic (1982) provides an important theoretical foundation by generating patterns of growth and failure for profit-oriented firms. Firms are assumed to be heterogeneous with respect to efficiency and cost levels. Firms do not know about their 'true' efficiency when starting operations, but collect relevant information over the course of time: "Efficient firms grow and survive; inefficient firms decline and fail" (Jovanovic, 1982, p. 649).[19]

[17] See Charity Navigator's website for details: http://www.charitynavigator.org/index.cfm?bay=content.view&cpid=33 (accessed: July 2012). Charity Navigator has announced to further enhance its methodology and include also qualitative assessments and outcome measures in the future. It is interesting to note that Szper and Prakash (2011) find for a small sample of NGOs in the state of Washington that changes in ratings by Charity Navigator hardly affected donor support in the past. For recent moves towards multidimensional assessments by watchdogs, see also Lecy et al. (2012, p. 446).

[18] As noted by the Nonprofit Overhead Cost Project (2004a) and also by Szper and Prakash (2011), overhead expenditure is necessary for successful program outcomes, at least up to a degree. See also Nonprofit Overhead Cost Project (2004b) for a short account of the pros and cons of financial standards.

[19] See also Zingales (1998) on why size may be a proxy for efficiency.

Harrison and Laincz (2008) present a modified version of Jovanovic's model of industry dynamics for non-profits. These authors incorporate two defining features of non-profits into the selection model: the non-distribution constraint and altruism.[20] Both features have the effect that the exit rates of non-profits are systematically lower than the exit rates of profit maximizers. Altruism acts like a subsidy on output; i.e., an altruistic NGO manager decides on output as if the NGO had lower effective costs. Conversely, for any given level of cost or efficiency, a profit maximizing firm is more likely to exit the market than the altruistic NGO. This is all the more so when the non-distribution constraint is taken into account. The non-distribution constraint implies a lower liquidation value of NGOs, compared to profit-oriented firms whose assets could be sold and distributed upon exit. Consequently, non-profits tend to incur higher costs than profit maximizers until the outside option becomes more favorable than continuing operations.

The comparison of non-profits and profit maximizers is of principal interest in studies of 'mixed' industries such as Deily et al.'s (2000) analysis of different types of ownership of hospitals (non-profits, for-profits and government-run) in the United States. By contrast, our focus is on the heterogeneity among NGOs in international development.[21] As stressed by Lakdawalla and Philipson (2006) as well as Harrison and Laincz (2008), the survival and exit of non-profits can be modeled as by Jovanovic (1982) for profit-oriented firms. Specifically, the above noted reinterpretation of NGOs' effective costs does not invalidate the reasoning that more efficient market participants are less likely to exit than their peers.

Refined measures of efficiency go beyond indirect proxies such as the size and age of firms and non-profits, which we introduce as control variables further below. Industry studies such as Zingales (1998) employ return on sales or assets, per-unit costs and technical efficiency (i.e., the estimated distance from the production possibility frontier) as measures of firm-level efficiency. Deily et al. (2000) assess the relative efficiency of specific ownership types of hospitals by using the residuals from estimations of a stochastic frontier cost function. Data limitations prevent us from employing such measures in the present context. Nevertheless, the database on NGOs in international development offers sufficient information to capture the efficiency price of NGO aid. As noted before, this frequently used concept considers NGO expenses for administration and fundraising to be

[20] Altruism weakens or removes the profit motive of NGO staff and managers. Hence, NGOs may be regarded as "profit-deviators" in the jargon of Lakdawalla and Philipson (2006).

[21] It would be interesting to compare survival and exit between NGOs and profit-oriented contractors of official donor agencies as alternative aid channels. However, comparable data for profit-oriented contractors of USAID, for example, are not available to the best of our knowledge.

unproductive in the sense that they are not (directly) related to the charitable activities of the NGO (e.g., Ribar and Wilhelm, 2002; Castaneda et al., 2008; Aldashev and Verdier, 2010). The higher the share of these expenses in total expenditures, the less efficient the NGO is supposed to be from a purely financial or economic perspective. We follow this literature and hypothesize that NGOs with higher unproductive expenses are more likely to exit international development activities (hypothesis 1).

However, hypothesis 1 has to be qualified in several respects. First, as noted before, headquarter services are needed to a certain degree for NGO effectiveness in delivering results in the field (Szper and Prakash, 2011). The Nonprofit Overhead Cost Project (2004a, p. 3) of the Urban Institute and Indiana University concludes from nine detailed case studies that "nonprofits that spend too little on infrastructure have more limited effectiveness than those that spend more reasonably. Thus, in addition to the ceilings on these cost ratios that many watchdogs set, floors should perhaps be introduced as well." Second, administrative costs and fundraising do not necessarily resemble each other in reducing the probability of survival. In particular, the effect of fundraising is ambiguous to the extent that it helps mobilize additional financing. Third, the distinction between mechanistic and organic NGO structures may qualify the expected effects of administrative costs, too. The reasoning of Wollebaek (2009, p. 272) implies that organic structures tend to be associated with less administrative costs due to low levels of formalization.[22] Fourth, the relevance of hypothesis 1 can be questioned even more fundamentally recalling from section 4.2.2 that non-financial norms and expectations may be as important for NGO survival as organizational efficiency.

Even in the economics literature, the emphasis of recent studies often extends beyond narrow concepts of the efficiency of firms and NGOs. Firm characteristics such as domestic versus foreign ownership and export orientation have received considerable attention as additional determinants of firm survival and market exit.[23] The role of financing has been addressed for the survival of firms as well as non-profits. In a theoretical model, Clementi and Hopenhayn (2006) analyze the role of financing constraints on firm dynamics. These authors extend models such as Jovanovic (1982) by stressing the relevance of the structure of financing (i.e., by relaxing the Modigliani-Miller proposition). The model of Clementi and Hopenhayn (2006) predicts that the conditional probability of firm survival increases

[22] All the same, this author expects that "a strongly organic structure is generally a liability for the survival of local voluntary associations."

[23] See, for instance, Mata and Portugal (2002), Görg and Strobl (2003), Bernard and Jensen (2007), Görg and Spaliara (in press), Holmes et al. (2010), and Bandick (2010).

with equity financing. Likewise, Musso and Schiavo (2008) argue that it is more difficult for financially constrained firms to grow and to survive. Zingales (1998, p. 935) finds in an empirical study of the US trucking industry that "sometimes natural selection leads to the survival of relatively inefficient firms, which happen (or choose) to have deep pockets." According to Görg and Spaliara (in press), financial health – proxied, inter alia, by a high ratio of equity to total assets and a low ratio of short-term debt to assets – is associated with better survival prospects for French and UK firms.

The dichotomy between equity and debt may play a minor role for non-profits compared to profit-oriented firms. Nevertheless, deep financial pockets and financial health may be related to the structure of financing in the case of NGOs in international development, too. Specifically, Harrison and Laincz (2008, p. 35) conclude that it demands further study to assess whether low exit rates of NGOs could be attributed to "government grants keeping inefficient charities alive". Fernandez (2008) expects reliable and predictable government funding to improve the chances of NGO survival, even though it may erode the legitimacy of NGOs among private donors (hypothesis 2).[24]

However, the relationship between public funding and NGO survival is fairly complex. It cannot be ruled out that more efficient NGOs prefer not to draw on public funds in order to prevent government meddling into their operations. Moreover, public funding may weaken the link between NGO efficiency and market exit by relaxing budget constraints if NGOs anticipate that waste will not be effectively sanctioned by the state authorities due to bureaucratic slack. Government regulations may be insufficiently strict to have an impact on NGO behavior, or the enforcement of regulations may be in doubt (section 4.2.2).

On the other hand, official aid agencies should find it easier than private donors to screen the NGOs and allocate funding accordingly. Monitoring by watchdogs like Charity Navigator appears to have become more common recently. Throughout the period of observation, however, it is most reasonable to assume that mainly the official financiers engaged in monitoring of NGOs. Note also that purely financial criteria of NGO behavior tend to play a larger role when it comes to 'upward accountability' of NGOs to state authorities. Inefficiency as defined here is thus more likely to be exposed in case of NGOs with public funding. In other words, we hypothesize that efficiency becomes more important for

[24] However, private donors may react positively if government funding is regarded as a signal of official approval of the NGO and the urgency of its social cause. Indeed, empirical evidence on government funding of NGOs having negative effects on private donations (crowding out) is weak at best (e.g., Ribar and Wilhelm, 2002).

the survival of NGOs once they accept public funding and scrutiny (hypothesis 3). The interrelations between public funding, NGO efficiency and survival have received scant attention in the empirical literature on internationally active NGOs.As noted above, Eckerd and Moulton (2011) as well as Moulton and Eckerd (2012) consider public funding as an important element of the external environment, which tends to be associated with the adoption of particular types of performance evaluation (Eckerd and Moulton, 2011) and particular NGO roles (Moulton and Eckerd, 2012).

In addition, we account for several NGO-specific characteristics that are fairly standard in the relevant literature. Importantly, we control for the size and age of NGOs. The selection model of Jovanovic (1982) predicts that larger and more experienced firms are less likely to exit the market. Such firms have received favorable cost information in the past (which allowed them to grow) and gained a more precise view of their 'true' efficiency so that additional cost information in the future is less likely to be unfavorable enough to trigger exit (Dunne et al., 1989, p. 679). The theoretical predictions of Jovanovic's model on the role of firm size and age for the probability of market exit are also relevant for non-profits. In research on organizational ecology, sociologists and political scientists have coined the notions of 'liability of newness' and 'liability of smallness' to stress the role of age and size for survival in different populations of organizations, including NGOs (Freeman et al., 1983; Twombly, 2003; Wollebaek, 2009, e.g.,).

The important role of firm size and age has been supported in empirical industry studies. Earlier analyses finding these firm characteristics to be positively associated with firm survival focus on manufacturing industries in the United States (Evans, 1987; Dunne et al., 1989; Audretsch and Mahmood, 1995, e.g.). Similar results are reported for other countries, including Ireland (Görg and Strobl, 2003), Portugal (Mata and Portugal, 1994, 2002), and the United Kingdom (Disney et al., 2003).[25] Likewise, size and age figure as key determinants of exit and survival in empirical studies on non-profits. Most of these studies analyze NGOs with local activities such as social services; examples include: Twombly (2003); Fernandez (2008); Harrison and Laincz (2008); and Wollebaek (2009). While NGOs engaged in international development have received only scant attention, we expect that the probability of exit decreases with the size and age of this type of NGO, too.

Finally, market exit may depend not only on firm-specific or NGO-specific characteristics

[25] However, some empirical studies find more ambiguous effects of firm size on survival and exit; examples include Holmes et al. (2010) on micro-enterprises in the United Kingdom and Wagner (1994) on small German firms.

but also on the competitive environment in which firms and NGOs operate. Hence, we control for the density of organizations in a particular market and the concentration of resources in the largest organizations. Twombly (2003, p. 217f) argues that "a central tenet of the population ecology theory is the degree of competition among groups that exists within systems," and he expects that available "resources may be insufficient to sustain organizations when faced with many competitors."[26] All the same, exits may be relatively frequent in the early stages of market development as long as the legitimacy of the still small population of organizations is rather weak (Fernandez, 2008; Wollebaek, 2009). In other words, the probability of exit may fall from a relatively high level before rising again when the population of organizations has become sufficiently large so that competition effects are likely to dominate the process of building legitimacy. Considering that most areas of international development are unlikely to suffer from insufficient legitimacy, we expect exits to be positively associated with the density of NGOs.[27] The density measure should be lower when market consolidation has taken place already. At the same time, resource concentration could be higher in consolidated markets. Exits might therefore become less likely with increasing resource concentration.

4.3 Data and method

4.3.1 Sample and variables

We make use of the extensive database compiled by Rachel McCleary on US based NGOs with activities in international development in order to assess the hypotheses introduced in the previous section. The database offers annual information of major revenue and expenditures items that the NGOs are required to report when they register with the United States Agency for International Development (USAID).[28] In the present context, the most

[26] A similar line of reasoning can be found in studies on firm survival (e.g., Bandick, 2010).

[27] By contrast, Wollebaek (2009, p. 271) expects "legitimation effects to be more prevalent than competition effects" with respect to the survival of local NGOs in Norway.

[28] We carefully checked alternative data sources offering more recent information and covering a larger selection of NGOs with international activities, notably the Urban Institute's National Center for Charitable Statistics (NCCS). However, it proved impossible to use NCCS data for our estimations below. Our analysis focusses on the impact of administrative costs and the structure of NGO financing on exit probabilities. While the relevant variables appear on (the current version of) the original (tax) Form 990, administrative costs as well as public funding are not given in the so-called NCCS Core Files; see also Lecy (2011) on the limitations of the Core Files. Other NCCS files could not be used either for our purposes. For example, the so-called IRS Statistics of Income Sample (SOI) Files include more detailed financial data, but only for a sample of mainly large NGOs. Other files such as the NCCS / GuideStar National Nonprofit Database cover

relevant items include:

- total expenditures as a measure of NGO size, including both international and domestic activities;[29]
- the year in which the NGO registered with USAID, serving as our proxy of its experience in international development;[30]
- the costs for administration and management as well as the expenses for fundraising: higher shares of these two expenditure items in total expenditures are supposed to reveal relatively inefficient NGOs in terms of higher non-charitable spending;
- the financing structure of NGOs, notably the availability of public funds (from USAID, other US government sources, foreign governments and international organizations) and private donations.[31]

The subsequent analysis covers 887 NGOs based on data for the 1984-2005 period.[32] We chose 1984 as the starting point as the database offers uninterrupted time series since then, while some earlier years are completely missing. While the database extends to 2005, we consider 2003 as the final year to identify exits within our NGO sample. Note that NGOs are not necessarily active from the very beginning of the period of observation. As a result of exits and later entries, the average 'stay' of an NGO in the database amounts to almost eight years so that we could theoretically make use of close to 7,000 observations in the most basic specification of our probit model in table 4.4 below. However, due to missing observations in the explanatory variables the estimation comprises only about 6,000 observations. During the period of observation, we observe 293 exits of NGOs (see below for details).

We define entry, exit and experience (age) of NGOs in international development based on their appearance and disappearance in the database. This is in line with Zingales (1998,

just a few years. Furthermore, as noted by Reid and Kerlin (2006, p. 51), separating program expenditures for international and domestic programs is not feasible using information from the NCCS / GuideStar National Nonprofit Database. However as explained in more detail below, we draw on more recent data from the so-called VOLAG reports of USAID in order to test whether our results also hold for an extended period of observation.

[29] The share of international activities is reported, too. We use this share as a control variable below.

[30] Alternatively, we consider the founding year of the NGO.

[31] Note that we consider the sum of public funds from all sources listed in parentheses. The NGOs' own resources raised, for example, through commercial activities (sales, fees, etc.) represent the third major source of revenues.

[32] However, we use more recent data in section 4.4.2.

p. 913) who assumes that a (trucking) firm exits when it disappears from the files of the American Trucking Association. Specifically, we define exits from international development as previously active NGOs that are no longer listed in the database in the current year and do not re-appear in the files throughout the remaining period of observation.[33] We take into account that an NGO may fail to report the required balance-sheet information to USAID in a particular year, though still being active in international development. If an NGO re-appears in the database after just one missing year, we keep the NGO in the sample treating as missing only the year without reporting.[34] By contrast, we drop those NGOs from the sample which re-appear in the database after more than one year. While the database provides detailed information on a broad spectrum of NGOs, it does not cover the universe of relevant NGOs. Sample selection bias cannot be ruled out, even though the bias is probably smaller than in previous studies on foreign aid granted by a limited set of NGOs.[35] NGOs have to meet several conditions when they register with USAID.[36] They have to be US based, solicit cash contributions from the US general public, and conduct overseas program activities that are consistent with the general purposes of the US Foreign Assistance Act and/ or Public Law 480. As noted before, 'supporting services' shall not account for more than 40 per cent of total expenditure. Furthermore, registered NGOs must be exempt from federal income taxes under section 501(C)(3) of the Internal Revenue Code. They must be incorporated for not less than 18 months and provide financial statements to the public upon request, in line with generally accepted accounting principles (GAAP).

NGOs have to register in order to become eligible to compete for specific types of funding, e.g., development and humanitarian assistance grants. Apart from general USAID conditions of registration as noted above, specific groups of NGOs were effectively banned at least temporarily from entering into the competition for public funds. NGOs engaged in counseling on family planning and abortions provide a case in point during the Bush administration. On the other hand, NGOs such as Oxfam may decide deliberately not to

[33] As discussed in more detail below, we cannot rule out that NGOs leave the USAID registry while continuing international operations. We address the risk of 'classification error' in different ways, including various robustness tests.

[34] This applies to about four per cent of the overall sample of NGOs. Results are robust to a different treatment of these NGOs (see the appendix for details).

[35] For instance, Ribar and Wilhelm (2002) use a sample of 125 US based NGOs. Koch et al. (2009) assess aid allocation based on a sample of 61 NGOs based in different countries. The sample of about 300 Swiss NGOs used by Dreher et al. (2012) is relatively large, though still much smaller than the sample in the present paper.

[36] For more details, see: http://idea.usaid.gov/sites/default/files/attachments/conditions_us_organizations.pdf (accessed: August 2013).

accept public funds in order to operate independently. We miss this group of NGOs in the estimations reported below as they are most unlikely to be registered with USAID. Hence, NGOs relying exclusively on private donations and own resources are likely to be underrepresented in the registry.

4.3.2 Sample characteristics

Nevertheless, we do not rely exclusively on NGOs for which public funding plays a major role. Our sample includes various NGO-year combinations with public funding equal to zero (about 30 per cent of all observations). Furthermore, table 4.1 suggests that our sample is fairly representative in terms of the average share of public funds in total revenues. In the table, we compare important characteristics between of our sample of NGOs with USAID registration and all NGOs included in category Q (i.e., NGOs with international/ foreign activities) of the Urban Institute's National Center for Charitable Statistics (NCCS). We draw on the relevant statistics for selected years presented in a recent study of the international NGO subsector by the Urban Institute (Reid and Kerlin, 2006). This comparison, though possible for only a few years, should reveal possible biases given that the statistics presented by Reid and Kerlin are based on a much larger number of NGOs most of which are not registered with USAID. As can be seen, public funding is more important for the sample underlying our estimations than for all NGOs classified in category Q by NCCS. However, the difference is smaller than one might have expected (3-6 percentage points).

We also compare average administrative cost shares in table 4.1. This may indicate whether more or less efficient NGOs (in terms of administrative costs) self-select into the USAID registry. On the one hand, inefficient NGOs may not register anticipating that they may be unable to comply with USAID's threshold concerning 'supporting services'. On the other hand, more efficient NGOs may choose not to register to avoid USAID interference into their financing and program decisions.[37] Table 4.1 indicates that NGOs in our sample tend to be less efficient in terms of administrative cost shares, compared to all NGOs covered in NCCS. However, the difference is relatively small (about three percentage points). It may also be noted that administrative cost shares exceed USAID's threshold of 40 per cent for about 1.5 per cent of all observations in our sample, possibly implying that the threshold is not rigorously enforced.

[37] We are particularly grateful to the anonymous reviewers who alerted us to the possibilities of self-selection working in different directions.

Tab. 4.1: Major characteristics of USAID sample and international nonprofit subsector

	USAID		Reid and Kerlin (2006)	
	2001	2003	ca. 2001	ca. 2003
Number of NGOs	471	529	3,653	4,199
Size (average expenditures, million US $)	29.3	28	—	4.1
Fundraising	5	4	5	4
Administrative costs	10	10	7	7
Public funding	24	23	18	20

Fundraising and administrative costs in per cent of total expenditures; public funding in per cent of total revenues

As concerns the average fundraising effort, our sample does not differ from all NGOs with international activities included in NCCS. Taken together, these observations make us confident that our sample is not seriously biased against NGOs with a considerably higher or lower efficiency price of aid, as defined in section 4.2. We do observe a strong bias of our sample towards comparatively large NGOs, however. This could imply that the exit rates in our sample are biased downwards, recalling the hypothesis on the 'liability of smallness' from section 4.2.

Figure 4.1 and table 4.2 present some stylized facts about the frequency of exits and unconditional exit probabilities. The annual exit probability is about 4.8 per cent, on average, in figure 4.1. This compares to the somewhat lower exit rates of 2.9 per cent in the pre-1999 period and 4.1 per cent in the post-1999 period reported by Lecy (2011). Table 4.2 provides some preliminary indications on unconditional exit and survival probabilities for subgroups of NGOs in a specific year. The overall NGO sample is classified into sub-groups in terms of major characteristics such as size, age, non-charitable ('unproductive') expenditures, and financing structure. Some interesting patterns emerge that will be analyzed more systematically below. For instance, the exit probability appears to be relatively low for larger and older NGOs. The exit probability of NGOs with a particularly high share of administrative costs in total expenditures is almost 9 per cent, compared to 3-3.5 per cent for NGOs which keep administrative costs in check. Public funding seems to be associated with better chances of survival, though this effect may level off once a certain degree of public funding is available. Exits are more common among secular NGOs than among religious NGOs.

Tab. 4.2: Annual exit and survival probabilities for various NGO subsamples

NGO characteristic	Range	Survival probability	Exit probability
Size (total expenditures)	Smallest	89.6	10.4
	Lower-middle	94.9	5.1
	Upper-middle	97.0	3.0
	Largest	98.4	1.6
Age (since entry in USAID registry)	Youngest	93.1	7.0
	Young	92.0	8.1
	Middle	95.8	4.2
	Old	96.5	3.5
	Oldest	97.9	2.2
Administrative costs (share in total expenditures)	Lowest	96.5	3.6
	Low	97.1	2.9
	Middle	94.9	5.1
	High	95.6	4.4
	Highest	91.4	8.7
Fundraising expenses (share in total expenditures)	Lowest	95.8	4.2
	Low	95.4	4.7
	Middle	95.8	4.2
	High	96.3	3.7
	Highest	95.0	5.0
Public funding (share in total revenue)	Lowest	92.3	7.7
	Lower-middle	96.5	3.5
	Upper-middle	96.2	3.8
	Highest	96.0	4.0
Type	Secular	94.7	5.3
	Religious	96.0	4.0

The probabilities refer to the 5,949 observations covered by the baseline regression in table 4.4.

4.3.3 Identification of exits

The overall number of 293 exits in figure 4.1 may overstate the number of NGOs truly exiting from international development activities. This would happen if NGOs no longer registered with USAID, possibly because they were no longer interested in public funding, while they continued operating without USAID funding. We attempted to assess the severity of possible bias due to 'classification error' by searching two well-known sources listing internationally active NGOs for the NGOs with exits from the USAID registry: the Yearbook of International Organizations published by the Union of International Associations and the so-called Core Files of the Urban Institute's National Center for Charitable Statistics (NCCS).[38]

[38] Both databases can be accessed online after registration and paying subscription fees; for details see: http://www.uia.be/yearbook-international-organizations-online and http://nccs.urban.org/database/overview.cfm.

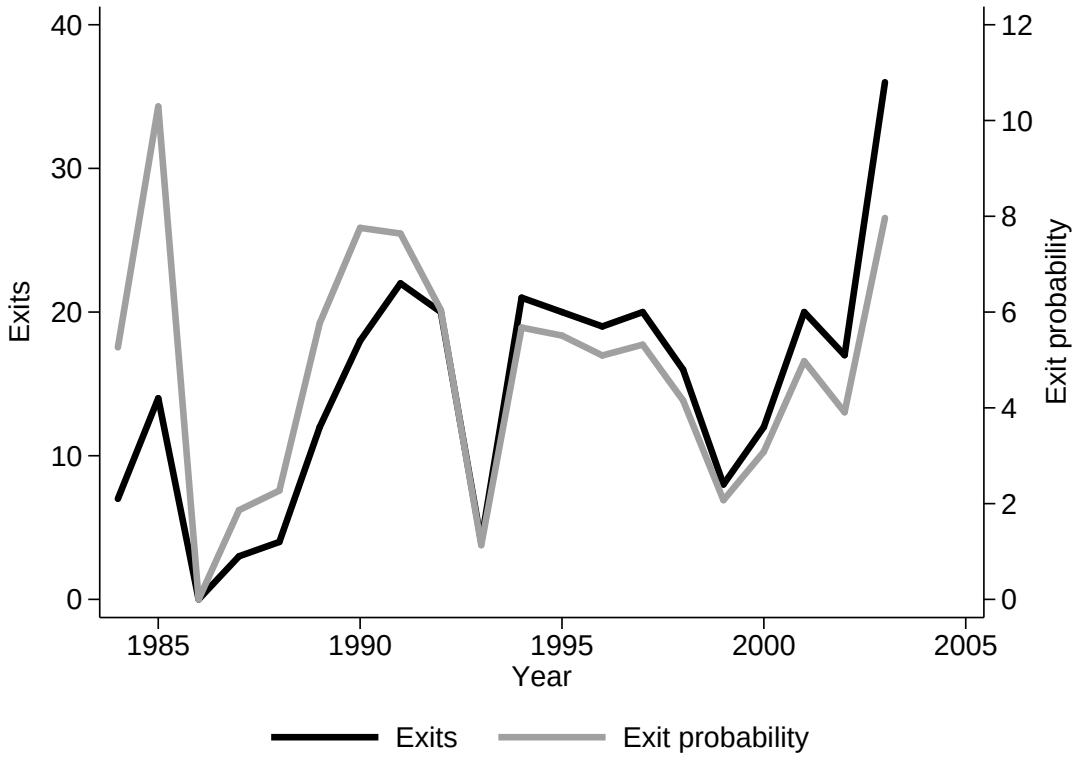


Fig. 4.1: Annual exits and unconditional exit probabilities in per cent

The Yearbook of International Organizations offers an online database of international non-profits (including NGOs) worldwide. Searching this database we identified just 30 per cent of the NGOs with exits from the USAID registry. Classification error cannot be ruled out for those NGOs not listed in the Yearbook. However, the risk of misclassification appears to be minor for this large group of NGOs at closer inspection of the Yearbook's guidelines for inclusion. The Yearbook attempts to cover all 'international organizations' by sending out questionnaires and relying primarily on information received from the responding organizations themselves. National organizations (in our case US-based NGOs) "with international programmes (e.g. aid programmes) may be included," but "organizations which are obviously bilateral are excluded." Moreover, "the aims must be genuinely international in character, with the intention to cover operations in at least three countries."[39] The selection criteria imply that we are most likely to miss NGOs in the Yearbook whose international activities are quantitatively small and/or restricted to one or two recipient countries. At the same time, the reasoning in section 4.2

[39] The quotes are from the Appendix of the 2012-2013 edition of volume 2 of the Yearbook.

suggests that 'true exits', in the sense of discontinuing international activities, are most likely for these NGOs.

About one third of the NGOs identified in the Yearbook did not only exit the USAID registry but are also coded explicitly as inactive, dormant or dissolved in the Yearbook, though the year since when they appear in these categories in the Yearbook often deviates from the year of exits from the USAID registry. On the other hand, we identified 62 NGOs with exits from the USAID registry which remained active even after various years according to the Yearbook. Classification error is most likely for this group.[40] The NCCS Core Files list US based NGOs whose primary purpose or mission is international in scope under category Q, while US based NGOs with mainly domestic activities are listed in various other categories. More than half of the 265 NGOs with exits in the 1989-2003 period (according to figure 4.1) did not appear in category Q of the Core Files.[41] The risk of 'classification error' appears to be minor for this group. Not being listed in category Q suggests that these NGOs were no relevant (or sufficiently large) actors in international development and, thus, more likely to discontinue international activities. It cannot be ruled out that we failed to identify some NGOs because of differences in spelling, however. It should also be noted that various NGOs could not even be identified in Core File categories other than Q. In other words, they did not file Form 990 throughout the period of observation. Two sub-groups of NGOs are not required to file Form 990: small NGOs not exceeding the filing exemption threshold and religious NGOs with filing exemptions. The assumption of 'true exits' appears to be reasonable for the first sub-group (see section 4.2). 'Classification error' may be more likely for the second sub-group so that we split the sample into religious and secular NGOs in the estimations reported in table 4.11 in the appendix.

We identified 207 of the 265 NGOs with exits in the 1989-2003 period (according to figure 4.1) in the NCCS Core Files. 47 of these 207 NGOs can be assumed to be 'true exits' in the sense that they are most likely to have discontinued international activities when they left the USAID registry. These NGOs also disappeared permanently from the Core Files at about the same time. In addition, some NGOs disappeared from the Core Files for various years (temporary exits). 140 of the cases in figure 4.1 continued to be listed in the Core Files after they had left the USAID registry. The risk of mis-classifying NGOs in this group as exits is relatively small when international program expenditures were

[40] See table 4.10 in the appendix for a robustness test related to the above discussion.

[41] Note that the Core Files are available only since 1989. This group includes some cases where NGOs with the same name appeared in the Core Files, but completely different revenue numbers suggest that they were not the same NGO as in the USAID registry.

steeply declining or even zero in the years preceding the exit from the USAID registry.[42] This applied to 28 NGOs. For the remaining 112 it is most likely that they continued to be active internationally even though they left the USAID registry. Again, we perform a robustness test by excluding these NGOs from our list of exits (table 4.10 in the appendix).

4.3.4 Estimation approach

Our estimation approach follows various studies on firm survival and market exit, including Zingales (1998) and Görg and Spaliara (in press). We start with a probit model to estimate the probability that US based NGOs discontinue international development activities in a particular year, conditional on a set of possible determinants observed in the previous year. In other words, we assume that the probability of exit, $Pr(Exit_{i,t} = 1)$, is a function of the vector of determinants, $\mathbf{X}_{i,t-1}$:

$$Pr(Exit_{i,t} = 1) = F(\boldsymbol{\beta}'\mathbf{X}_{i,t-1} + \delta_j + \gamma_t + \varepsilon_{i,t}) \tag{4.1}$$

with slope parameters $\boldsymbol{\beta}$, NGO type-specific fixed effects δ_j, year fixed effects γ_t, and a normally distributed error term $\varepsilon_{i,t}$.

In line with the reasoning in section 4.2.2, the vector of determinants includes the age of the NGO (logged: *Age*) as well as major expenditure and revenue items. Total expenditures (logged) reflect the size of NGOs (*Size*). The effect of both *Age* and *Size* on $Pr(Exit_{i,t} = 1)$ should be negative if more experienced and larger NGOs have better chances to survive. We also enter NGO size in squared terms (*Size*2*) to account for non-linear effects on $Pr(Exit_{i,t} = 1)$. The shares of administrative expenses and fundraising expenses in total expenditures, *Adminsh* and *Fundsh*, should have negative effects on $Pr(Exit_{i,t} = 1)$ if NGO efficiency in terms of containing non-charitable expenses improves the chances of survival. The impact of NGO financing is captured by the shares of public funding, *Publicsh*, and private donations, *Donationsh*, in total revenue – with the NGOs' own resources from commercial activity serving as the base (revenue) category. We control for the share of international activities, *Intfrac*, expecting that NGOs are less likely

[42] It is important to recall in this context that an NGO which discontinues international operations, while continuing operations within the United States, represents a 'true exit' for our analysis. A steep decline is defined to involve a reduction in international program expenditures by more than 50 per cent so that the NGO belonged to the lowest quintile in terms of international program expenditures in the year preceding the exit from the USAID registry.

Tab. 4.3: Summary statistics

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
Size	5,949	14.9	2.2	5.2	21.4
Age	5,949	2.0	1.0	0.0	4.2
Fundsh	4,377	5.4	5.5	0.0	27.0
Adminsh	5,750	11.4	9.4	0.0	54.9
Donationsh	5,945	61.1	34.7	0.0	240.1
Publicsh	5,945	25.2	30.7	0.0	118.9
Intfrac	5,949	77.1	34.4	0.0	100.0
NGOdensity	5,949	27.8	18.4	1.0	83.0
Herfin	5,949	26.3	18.2	6.6	100.0
PublicVol	5,909	88.1	2579.8	0.0	198038.5
DonationsVol	4,928	6.3	15.6	0.0	260.5

The summary statistics refer to the 5,949 observations covered by the baseline regression in table 4.4. In a few cases the share of donations or public funds in total revenues exceeds 100 per cent due to losses from commercial activities, i.e., negative entries for the third source of NGO revenues.

to discontinue international development activities when it accounts for a larger share in their program expenditures. Summary statistics are provided in table 4.3.[43]

In addition, we account for the competitive environment in which NGOs operate. The density of NGOs in a particular 'market' is proxied by the number of NGOs of a specific type (*NGOdensity*). The classification of NGOs into religious and secular types is also available from McCleary's database. Religious NGOs are subdivided into several faith-based groups such as Evangelical, Catholic and Jewish. Secular NGOs are differentiated further into 16 subgroups: agricultural development, communications, community/capacity building, culture and society, education/ higher learning, engineering/ infrastructure/ technology, environment, ethnic unity, foundations/ individuals, human rights/ international law, medicine and health, peace groups, professional associations, relief and development, gender issues/ family planning, and private enterprise/ small enterprise.[44] The concentration of resources – in terms of revenues – within these subgroups is measured by Herfindahl indices (*Herfin*). The regressors are measured at year

[43] Detailed definitions can be found in the appendix. It should be noted that we excluded some outliers (the highest percentile of NGO-year combinations) with extremely high shares of administrative costs and expenses for fundraising in total expenditures. After careful inspection of the data, it appears that these outliers are concentrated in the first year when NGOs register with USAID; charitable expenses are often still minor (or even zero) in the first year, resulting in exceptionally high values of *Adminsh* and *Fundsh*.

[44] Note that the classification of secular NGOs is according to their main line of activity. Additional lines of (minor) activities are not given in the source. We combined some very small sub-groups (with specific religious affiliations and areas of activity) when no exit was observed for a particular sub-group. In this way, we avoided the loss of observations.

$t-1$ to mitigate endogeneity concerns.[45] Finally, we account for NGO type-specific fixed effects, δ_j, based on the above classification, as well as year fixed effects, γ_t.

In subsequent steps of the analysis, the baseline probit model is modified in several ways (see section 4.4 for details). First, we perform various robustness tests and replicate the estimations for major sub-groups of the overall NGO sample (see also the appendix). Second, we draw on more recent data to evaluate whether financial and economic factors have lost importance over time. Third, we extend the specification by interaction terms. In particular, we evaluate in this way whether the effects of NGO efficiency in terms of *Adminsh* depend on the NGO's reliance on public funding (*Publicsh*) as well as its size. The interaction with *Publicsh* could reveal whether the relationship between NGO inefficiency and the probability of exit weakens when NGOs have easier recourse to official financiers, or whether monitoring of NGOs by official financiers even strengthens this link.[46]

4.4 Empirical results

4.4.1 Basic probit estimations

Table 4.4 presents the coefficients of the baseline estimations of our probit model. All estimations reported here and in the subsequent tables include year fixed effects as well as fixed effects for specific sub-groups of NGOs (for details, see section 4.3.4). Standard errors are clustered at the NGO level. In column (1) of table 4.4, we consider only the size and age of the US based NGOs, i.e., the two proxies that the earlier literature on firm survival widely used to capture cost efficiency and experience. Both measures enter with a significantly negative coefficient, at the one per cent level of significance.[47] This

[45] See also the appendix for IV probit model results.

[46] In the appendix, we also employ complementary log-log (cloglog) estimations in order to test for the robustness of our results to methodological choices. The cloglog model is the discrete time version of the Cox proportional hazard model. We prefer the probit model as a benchmark, however, since the assumption of proportional hazards has been shown to be restrictive and empirically questionable (Hess and Persson, 2012). In the appendix, we also take into account that some of our explanatory variables may be endogenous. Hence, we follow Wooldridge (2002) and use the instrumental variable technique for probit models (see also Görg and Spaliara, in press).

[47] By contrast, the coefficient of *Age* turns out to be insignificant when the founding year, instead of the year of registration with USAID, is considered. This result also holds for the subsequent specifications. Throughout our analysis, however, the signs and significance levels of other coefficients are not affected by the applied definition of *Age*.

Tab. 4.4: Baseline probit estimations

Variables	(1) probit	(2) probit	(3) probit	(4) probit	(5) probit
Size	-0.1404***	-0.1421***	-0.1343***	-0.4143**	-0.4291**
	(0.0139)	(0.0224)	(0.0153)	(0.1807)	(0.1887)
Size*2				0.0087	0.0092
				(0.0063)	(0.0066)
Age	-0.0990***	-0.1226***	-0.1160***	-0.0709	-0.0605
	(0.0335)	(0.0431)	(0.0348)	(0.0442)	(0.0444)
Fundsh		-0.0002	-0.0011	-0.0076	-0.0081
		(0.0072)	(0.0062)	(0.0073)	(0.0073)
Adminsh		0.0122***	0.0090***	0.0101**	0.0107**
		(0.0041)	(0.0031)	(0.0042)	(0.0042)
Donationsh				-0.0010	-0.0009
				(0.0018)	(0.0018)
Publicsh				-0.0051**	-0.0051**
				(0.0022)	(0.0022)
Intfrac				-0.0055***	-0.0055***
				(0.0013)	(0.0012)
NGOdensity					0.0062
					(0.0050)
Herfin					-0.0097**
					(0.0042)
Constant	0.2142	-0.0723	0.0600	2.5181*	3.0703**
	(0.3362)	(0.5550)	(0.3573)	(1.3698)	(1.4118)
Observations	5,949	4,319	5,673	4,316	4,316

Reports the coefficients. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level.

implies that larger and more experienced NGOs in our sample are more likely to survive with international development activities than smaller and younger NGOs. Quantitatively speaking, the marginal effects at the mean of the variables suggest that the exit probability decreases by 1.1 (0.8) per cent with an increase of size (age) by one per cent (table 4.5).

In columns (2) and (3) of table 4.4, we consider our two measures of unproductive expenses in addition to the size and age of NGOs in order to assess hypothesis 1 that NGOs with a higher efficiency price of NGO aid – i.e., spending relatively less on charitable activities – are more likely to exit international development. In line with this hypothesis, the coefficient of *Adminsh* proves to be significantly positive at the one per cent level. The marginal effect shown in column (2) of table 4.5 suggests that an increase in the share of administrative expenses in total expenditures by one standard deviation leads to an increase in the exit probability by 0.6 per cent. In contrast to *Adminsh*, *Fundsh* turns out to be insignificant at conventional levels of statistical significance. While both variables

Tab. 4.5: Marginal effects based on the baseline probit estimations

Variables	(1) probit	(2) probit	(3) probit	(4) probit	(5) probit
Size	-0.0108***	-0.0090***	-0.0100***	-0.0080***	-0.0079***
	(0.0010)	(0.0014)	(0.0011)	(0.0016)	(0.0016)
Age	-0.0076***	-0.0078***	-0.0086***	-0.0038	-0.0032
	(0.0026)	(0.0027)	(0.0026)	(0.0024)	(0.0023)
Fundsh		-0.00001	-0.0001	-0.0004	-0.0004
		(0.0005)	(0.0005)	(0.0004)	(0.0004)
Adminsh		0.0008***	0.0007***	0.0005**	0.0006**
		(0.0003)	(0.0002)	(0.0002)	(0.0002)
Donationsh				-0.0001	-0.0000
				(0.0001)	(0.0001)
Publicsh				-0.0003**	-0.0003**
				(0.0001)	(0.0001)
Intfrac				-0.0003***	-0.0003***
				(0.0001)	(0.0001)
NGOdensity					0.0003
					(0.0003)
Herfin					-0.0512**
					(0.0226)
Observations	5,949	4,319	5,673	4,316	4,316

Reports the marginal effects at the mean of the explanatory variables. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level.

reveal unproductive expenses in the sense of not being directly related to charitable activities, the effect of fundraising could be expected to have ambiguous effects on exit and survival (see section 4.2). Even though private donors may dislike NGOs engaging in 'excessive' fundraising (Rose-Ackerman, 1982), fundraising has often been found to result in higher donations which, in turn, may render exit less likely.[48] The control variables *Size* and *Age* keep their significantly negative coefficients, indicating that the extended specification compared to column (1) offers additional explanatory power with regard to NGO efficiency and the probability of exit.

Note that *Fundsh* is insignificant in columns (2) and (3) of table 4.4, i.e., independently of how we deal with missing entries for fundraising. One option is to assume that fundraising expenses are zero whenever the costs for administration and management and the program-related expenditures add up to total expenditures of NGO i in year t. This assumption is underlying the estimation reported in column (3). Alternatively, we drop those

[48] For a more detailed discussion and review of the relevant literature, see Nunnenkamp and Öhler (2012b).

NGO-year combinations (column 2). The latter option runs the risk of losing 'true' zero observations when an NGO did not undertake any fundraising. Careful inspection of the data suggests, however, that fundraising is sometimes not reported. The zero assumption would then clearly be unwarranted. Fortunately, the choice between these two options hardly affects our results. The significance levels as well as the size of the coefficients for all variables are very similar in columns (2) and (3). In all subsequent estimations, we proceed with the more cautious option used in column (2).[49]

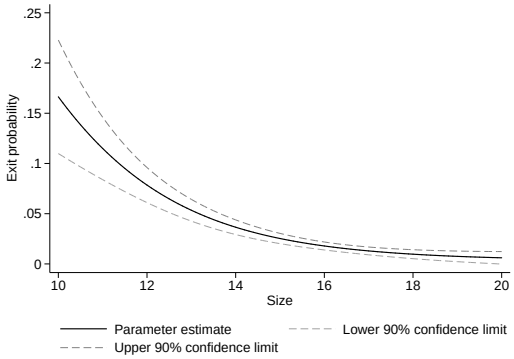
In column (4) of table 4.4 we refine the specification of the probit model in three respects: We account for non-linear effects of the size of NGOs on exit and survival by adding the variable in squared terms (*Size*2*); we include *Donationsh* and *Publicsh* to assess the role of NGO financing; and we control for the international share of NGO activity (*Intfrac*). *Age* loses its significance in the extended specification in column (4).[50] The (positive) coefficient of *Size*2* also fails to pass conventional significance levels. However, Ai and Norton (2003) show that the significance levels of the coefficients of any kind of interaction terms (including squared terms) cannot be interpreted in non-linear models such as the present probit model. Indeed, there is clear evidence for non-linear effects once the marginal effects are calculated conditional on the level of the variable *Size* itself. Figure 4.2a reveals that the exit probability decreases considerably when NGOs at the lower end of the size distribution grow larger. This effect diminishes and eventually approaches zero when NGOs move up in the size distribution. Quantitatively, an increase by one per cent in size leads to a decrease in the exit probability by 5.7 per cent at the lower end of the distribution (1st percentile), to a decrease by 0.8 per cent at the median, and to a decrease by 0.1 per cent at the upper end of the distribution (99th percentile).

The evidence on the role of financing is mixed. A larger share of private donations in the NGOs' total revenues does not affect the probability of exit in a significant way.[51] In contrast, a higher share of public funding is associated with a lower exit probability

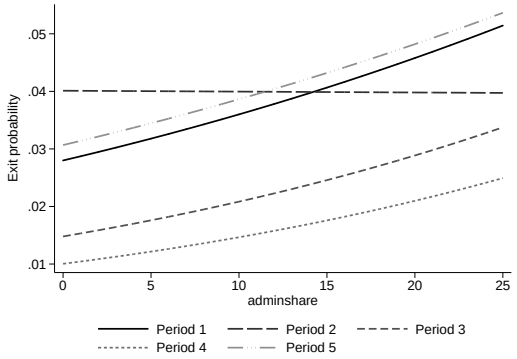
[49] As *Fundsh* turns out to be insignificant, we also performed estimations in which we dropped *Fundsh* completely. While these results are not shown in detail, we note the most relevant findings and differences in the subsequent text.

[50] In unreported additional estimations, we entered the funding variables (*Donationsh*, *Publicsh*), *Intfrac*, and *Size*2* separately to see the reason why Age loses its significance in column (4). Adding only *Size*2* does not affect the significance of Age. Age also remains significant when entering either the funding variables or *Intfrac*. *Age* becomes insignificant at conventional levels only when entering the funding variables together with *Intfrac*. Note also that *Age* remains significant at the five per cent level when dropping *Fundsh*. On the other hand, *Publicsh* turns out to be insignificant at conventional levels in the unreported results without *Fundsh*.

[51] As mentioned in section 4.3, a higher share of private donations corresponds to a lower share the NGOs' own resources from commercial activity which represent the reference (revenue) category.



(a) Exit probability depending on *Size*; non-linear relationship (according to column 5 in table 4.4).



(b) Exit probability depending on *Adminsh* and time periods (according to column 5 in table 4.7).

Fig. 4.2: Conditional exit probabilities

at the five per cent level of significance. The latter result is in line with hypothesis 2 according to which public funding improves the chances of NGO survival by relaxing budget constraints. Quantitatively, an increase by one standard deviation in the share of public funding would reduce the exit probability by 0.8 per cent. This is not to ignore that the negative coefficient on public funding could be due to the fact that NGOs must register with USAID to be eligible for public funding. We consider this to be unlikely, however, recalling two observations from section 4.3: public funding was zero for about 30 per cent of all observations in our sample of NGOs with USAID registration; and the average share of public funding was only modestly higher in our sample, compared to all NGOs with international activities covered by NCCS (table 4.1).[52] Hence, our finding appears to be more in line with Fernandez (2008, p.131) who concludes from his analysis of 41 dissolved Spanish NGOs that "state funding helps nonprofit associations to survive." However, it can not necessarily be inferred from this result that public funding helps inefficient NGOs to survive. We return to this issue below. The estimation in column (4) also shows – as expected – that NGOs are less likely to discontinue international activities if they figure more prominently in their portfolio (*Intfrac*).

We further extend the specification by controlling for two indicators on the competitive environment in which NGOs operate. The density of NGOs in a particular sub-group enters with a positive coefficient in column (5) of table 4.4 – as one would expect when a larger number of market participants is associated with fiercer competition. However,

[52] It may also be noted in this context that *Publish* remains significantly negative when possible endogeneity is accounted for in the IV probit estimations reported in table 4.12 of the appendix.

NGOdensity does not pass conventional significance levels.[53] The concentration of resources turns out to be significantly negative at the five per cent level. As noted in section 4.2.2, resources may be concentrated more strongly when market structures are consolidated so that further exits become less likely. Importantly, the inclusion of *NGOdensity* and *Herfin* does not affect previous results on our variables of major interest (*Adminsh* and *Publicsh*). The size and significance of their coefficients are essentially the same when comparing columns (4) and (5).

To account for possible endogeneity we also estimate an instrumental variable probit model. As instruments we use the level of *Size*, *Size*2*, *Fundsh*, *Adminsh*, *Donationsh*, *Publicsh* and *Intfrac*, all lagged by two and three periods. We test for the validity and relevance of our instruments based on a linear version of the IV model, as in Görg and Spaliara (in press). The tests confirm that our instruments are valid and relevant. A notable difference to the baseline probit model is that the coefficients of *Adminsh* are now no longer significant, though their signs are as before. Yet, this does not imply that NGO efficiency becomes irrelevant for the probability of exit. *Size* effects are hardly affected by employing IV probit estimations. Furthermore, it appears that the second traditional proxy of efficiency, *Age*, now captures part of the effect previously attributed to Adminsh. Most importantly perhaps, there appears to be little reason to be concerned about the endogeneity of our regressors. Wald tests indicate that exogeneity of the regressors cannot be rejected. Consequently we tend to prefer the simple probit results, while it is reassuring to find them to be broadly robust to instrumental variable estimations (see table 4.12 in the appendix).

4.4.2 Accounting for recent developments

The estimations reported so far are based on data from Rachel McCleary for the 1984-2005 period. The major advantage of this dataset is that it is particularly rich: in addition to financial accounting items, it offers information on important NGO characteristics such as their age and area of activity. Moreover, the dataset covers more than 20 years of NGO activity in a fully consistent way. Exclusively relying on this dataset implies, however, that one cannot account for more recent developments with regard to NGO accountability. As discussed in section 4.2.1, the relevance of financial and economic factors may be questioned to the extent that NGO behavior is shaped increasingly by donor expectations and self-regulation among peers. Stricter monitoring by watchdogs is a recent

[53] *NGOdensity* proves to be significant at the ten per cent level, however, when dropping *Fundsh*.

phenomenon, and the conditions attached to public funding may also have become more binding over time. All this may affect the determinants of the probability of NGO exits so that it is clearly desirable to extend the period of observation and cover more recent data.

We approach this issue in several ways. First, we replicate the estimations reported in table 4.4 for the 1990-2009 period by drawing on data for US based NGOs with international activities from the so-called VolAg reports of USAID.[54] Second, we combine the McCleary database with data from the VolAg reports which enables us to cover an extended period of observation, 1984-2009. Third, we introduce period dummies and interact them with *Adminsh* to investigate whether stricter monitoring of NGOs, notably by watchdogs, has strengthened the link between administrative costs and the probability of exit in the most recent past. Arguably, the increasing monitoring over time might have effects not only on the efficiency and exit probability of NGOs actually monitored at one particular point in time, but also on all other NGOs witnessing the trend toward broader coverage and anticipating that watchdogs might include them in their future monitoring.

In all three steps, the data from the VolAg reports have to be matched with information included only in McCleary's database. While the VolAg reports contain expenditure and revenue variables consistent with the master file received from Rachel McCleary, information on the year of foundation, the religious affiliation and the type of activity is missing in the VolAg reports so that we matched these variables from the McCleary master file.[55] It should be noted that the matching implies a loss of some information by reducing the sample of NGOs that can be included in the estimations. Specifically, all estimations reported in this section can cover only those NGOs that are listed in both, the VolAg database and the McCleary master file.[56] In other words, there is a trade-off between extending the period of observation and covering a larger sample of NGOs.

The results for the 1990-2009 period shown in table 4.6 largely confirm the effects observed in the baseline estimations. This applies particularly to our control variables. The significant findings on *Size*, *Intfrac*, and *Herfin* carry over almost unchanged. The negative effect of *Age* on the probability of exit strengthens in columns (3) and (4) of table

[54] VolAg stands for voluntary agencies. We combined online VolAg data for the 1990-2008 period available from: http://www.healthmetricsandevaluation.org/ghdx/record/ihme-formatted-usaid-volag-database-1990-2008 (accessed: August 2012), and the 2011 VolAg report of USAID available from: http://idea.usaid.gov/sites/default/files/attachments/volag2011_0.pdf (accessed: August 2012) on data for the year 2009.

[55] This was only possible as Rachel McCleary provided us with the true names of all NGOs in her master file.

[56] Note also that, similar to above, we lose the last two years when identifying the exits.

Tab. 4.6: Robustness test with the VolAg database (1990-2009 period)

Variables	(1) probit	(2) probit	(3) probit	(4) probit
Size	-0.1318***	-0.1213***	-0.2760***	-0.2856***
	(0.0132)	(0.0136)	(0.1005)	(0.1010)
Size*2			0.0047	0.0049
			(0.0036)	(0.0036)
Age	-0.1279***	-0.1318***	-0.0932***	-0.0887**
	(0.0329)	(0.0329)	(0.0346)	(0.0345)
Fundsh		0.0039	-0.0005	0.0000
		(0.0046)	(0.0051)	(0.0052)
Adminsh		0.0069***	0.0052**	0.0050*
		(0.0023)	(0.0025)	(0.0026)
Donationsh			-0.0006	-0.0006
			(0.0012)	(0.0013)
Publicsh			-0.0017	-0.0018
			(0.0013)	(0.0013)
Intfrac			-0.0054***	-0.0054***
			(0.0009)	(0.0009)
NGOdensity				0.0090
				(0.0062)
Herfin				-0.0109***
				(0.0033)
Constant	0.4706	0.2200	1.9227**	2.4131***
	(0.3032)	(0.3161)	(0.7649)	(0.7921)
Observations	6,422	6,422	6,410	6,410

Reports the coefficients. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level.

4.6, compared to the corresponding estimations in table 4.4. As concerns our variables of major interest, the positive effect of *Adminsh* weakens somewhat in the fully specified model. Nevertheless, higher administrative cost shares continue to be associated with a higher probability of exit, at the ten per cent of significance, in line with hypothesis 1. However, table 4.6 does not support hypothesis 2 as *Publicsh* loses its significance.

Table 4.7 shows the estimations for the extended period of observation, 1984-2009. These results in columns (1)-(4) resemble the baseline results even more closely. Most importantly, as in table 4.4, we again find empirical support for both hypotheses 1 and 2. *Adminsh* enters significantly positive at least at the ten per cent level, while *Publicsh* enters significantly negative at the five per cent level. In the third step, we modify the full specification shown in column (5) of table 4.7 by including a dummy variable for each five-year interval throughout the extended period of observation, instead of the year fixed effects, and interacting these dummy variables with *Adminsh*. This modification hardly affects the

Tab. 4.7: Robustness tests with merged datasets (McCleary + VolAg; 1983-2009 period)

Variables	(1) probit	(2) probit	(3) probit	(4) probit	(5) probit
Size	-0.1328***	-0.1378***	-0.3414**	-0.3559**	-0.3483**
	(0.0129)	(0.0186)	(0.1569)	(0.1620)	(0.1566)
Size*2			0.0063	0.0067	0.0065
			(0.0054)	(0.0056)	(0.0054)
Age	-0.1147***	-0.1389***	-0.0880**	-0.0776*	-0.0678*
	(0.0314)	(0.0391)	(0.0399)	(0.0401)	(0.0386)
Fundsh		-0.0006	-0.0070	-0.0071	-0.0061
		(0.0061)	(0.0063)	(0.0063)	(0.0063)
Adminsh		0.0093**	0.0075*	0.0076**	0.0155
		(0.0037)	(0.0038)	(0.0038)	(0.0135)
Donationsh			-0.0009	-0.0009	-0.0010
			(0.0016)	(0.0016)	(0.0016)
Publicsh			-0.0043**	-0.0045**	-0.0044**
			(0.0019)	(0.0019)	(0.0019)
Intfrac			-0.0057***	-0.0057***	-0.0056***
			(0.0011)	(0.0011)	(0.0011)
NGOdensity				0.0086	0.0095*
				(0.0055)	(0.0048)
Herfin				-0.0099***	-0.0098***
				(0.0035)	(0.0035)
Periode2					0.2302
					(0.2740)
Periode3					-0.2078
					(0.2757)
Periode4					-0.3507
					(0.2807)
Periode5					0.2350
					(0.2637)
Periode2*Adminsh					-0.0169
					(0.0154)
Periode3*Adminsh					-0.0008
					(0.0153)
Periode4*Adminsh					-0.0026
					(0.0155)
Periode5*Adminsh					-0.0140
					(0.0147)
Constant	0.3902	0.3876	2.4891**	3.0709**	2.8457**
	(0.3085)	(0.4183)	(1.2062)	(1.2355)	(1.2069)
Observations	7,174	5,529	5,526	5,526	5,526

Reports the coefficients. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level.

coefficients of the other variables, including *Publicsh*. Recalling that the coefficients on the interacted variables cannot be interpreted in non-linear models, we calculate the prob-

ability of an NGO exit depending on *Adminsh* for each time interval. We would expect a steeper increase in the exit probability with increasing *Adminsh* in the most recent time interval, and a more modest increase in the earlier time intervals, if stricter monitoring, notably by watchdogs, increasingly exposed inefficient NGOs and alerted public and private donors. However, the exit probabilities shown in figure 4.2b do not provide evidence to this effect. In the most recent time interval (period 5), the exit probability is generally higher than in some earlier time intervals. But the exit probability hardly increases with higher values of *Adminsh* during period 5. The same applies to period 2. A significant increase of the exit probability with higher values of *Adminsh* is rather observed in periods 3 and 4 (the increase is not significant in period 1).

Taken all three steps together, the surprisingly robust findings suggest that recent developments with regard to NGO accountability have not rendered obsolete financial and economic determinants of NGO exit from international activities. Two observations in section 4.2 provide possible explanations: It appears that self-regulation among US based NGOs has remained relatively weak, and NGO monitors such as Charity Navigator based their ratings almost exclusively on financial indicators until recently.

4.4.3 Interaction terms and non-linear effects

The estimations presented so far focused on hypotheses 1 and 2, while we now turn our attention to hypothesis 3.[57] The probit estimations reported in columns (2), (4) and (6) of table 4.8 account for interactions between *Adminsh* and public NGO funding. We refer to *Publicsh* as our standard measure of public funding in columns (1) and (2), while we replace *Publicsh* by a dummy variable set equal to one whenever an NGO receives public funding, irrespective of its share in total funding, in columns (3) and (4) (*PublicD*). In columns (5) and (6), we consider the dummy variable *PublicD* together with the share of public funding *Publicsh*, for those NGOs receiving any public funds. Comparing the results between columns (1) and (2), columns (3) and (4), and columns (5) and (6), respectively, it can be seen that the extension by the interaction terms hardly affects the coefficients of our control variables. As concerns the coefficients of the interaction terms,

[57] The results shown in this section are based on the full NGO sample and the 1984-2005 period underlying our basic probit estimations. However, we replicated the same set of estimations for the extended period of observation and the reduced number of NGOs listed in both databases (McCleary and VolAg); detailed results are available on request. Unless noted otherwise, the results are hardly affected by the way of dealing with the above mentioned trade-off between extending the period of observation and covering a larger sample of NGOs.

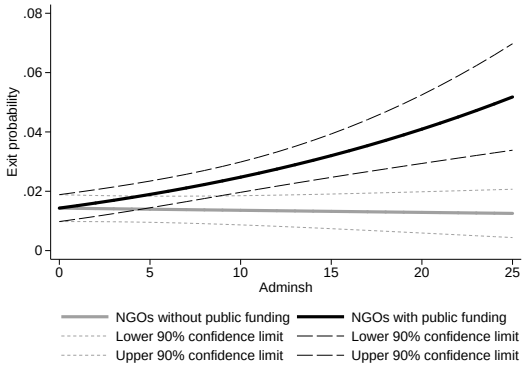
Tab. 4.8: Probit estimations, including interaction terms

Variables	(1) probit	(2) probit	(3) probit	(4) probit	(5) probit	(6) probit	(7) probit
Size	-0.4291**	-0.4331**	-0.4307**	-0.4767***	-0.4225**	-0.4695***	-0.4786***
	(0.1887)	(0.1876)	(0.1884)	(0.1814)	(0.1890)	(0.1819)	(0.1809)
Size*2	0.0092	0.0093	0.0096	0.0112*	0.0091	0.0108*	0.0104
	(0.0066)	(0.0066)	(0.0066)	(0.0064)	(0.0066)	(0.0064)	(0.0063)
Age	-0.0605	-0.0598	-0.0524	-0.0471	-0.0551	-0.0520	-0.0619
	(0.0444)	(0.0445)	(0.0453)	(0.0459)	(0.0453)	(0.0459)	(0.0444)
Fundsh	-0.0081	-0.0079	-0.0071	-0.0058	-0.0080	-0.0070	-0.0078
	(0.0073)	(0.0073)	(0.0073)	(0.0073)	(0.0073)	(0.0074)	(0.0073)
Adminsh	0.0107**	0.0095**	0.0110***	-0.0021	0.0107**	-0.0024	-0.0089
	(0.0042)	(0.0048)	(0.0042)	(0.0060)	(0.0042)	(0.0060)	(0.0272)
Donationsh	-0.0009	-0.0009	0.0012	0.0013	-0.0008	-0.0005	-0.0007
	(0.0018)	(0.0018)	(0.0015)	(0.0015)	(0.0018)	(0.0018)	(0.0018)
Publicsh	-0.0051**	-0.0063*			-0.0044*	-0.0004	-0.0050**
	(0.0022)	(0.0033)			(0.0024)	(0.0036)	(0.0022)
Publicsh_x_Adminsh		0.0001				-0.0003	
		(0.0002)				(0.0002)	
PublicD			-0.1603*	-0.4786***	-0.0788	-0.4892***	
			(0.0952)	(0.1392)	(0.1012)	(0.1579)	
PublicD_x_Adminsh				0.0245***		0.0326***	
				(0.0081)		(0.0094)	
Size_x_Adminsh							0.0015
							(0.0020)
Intfrac	-0.0055***	-0.0056***	-0.0062***	-0.0064***	-0.0056***	-0.0057***	-0.0055***
	(0.0012)	(0.0013)	(0.0012)	(0.0012)	(0.0012)	(0.0013)	(0.0012)
NGOdensity	0.0062	0.0062	0.0062	0.0055	0.0063	0.0056	0.0062
	(0.0050)	(0.0051)	(0.0051)	(0.0051)	(0.0051)	(0.0051)	(0.0051)
Herfin	-0.0097**	-0.0096**	-0.0097**	-0.0097**	-0.0097**	-0.0099**	-0.0098**
	(0.0042)	(0.0042)	(0.0043)	(0.0043)	(0.0042)	(0.0042)	(0.0042)
Constant	3.0703**	3.1066**	2.9059**	3.2949**	3.0040**	3.4127**	3.5000**
	(1.4118)	(1.4037)	(1.4037)	(1.3515)	(1.4151)	(1.3589)	(1.3694)
Observations	4,316	4,316	4,316	4,316	4,316	4,316	4,316

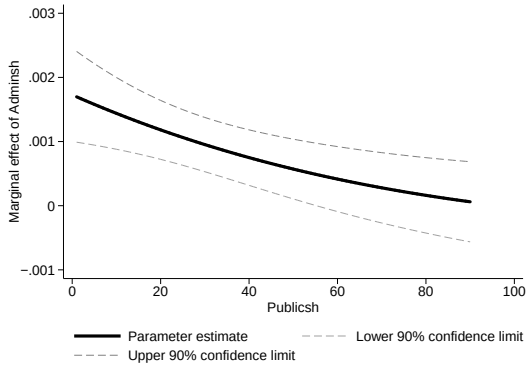
Reports the coefficients; for marginal effects, see the text. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level.

we noted already that their significance cannot be interpreted in non-linear models (Ai and Norton, 2003). Instead, we portray the exit probability depending on *Adminsh* for *PublicD*=0 and *PublicD*=1 in figure 4.3a, and – for those NGOs receiving any public funds – the marginal effect of *Adminsh* conditional on *Publicsh* in figure 4.3b.[58] Taking the evidence in both figures together points to fairly complex non-linear effects of administrative expenditures on the probability of exit. While we found before that the exit probability increases with higher administrative expenditures, figure 4.3a suggests that this only applies to the sub-sample with public funding (*PublicD*=1). In contrast, the exit probability is essentially the same across the whole spectrum of *Adminsh* for the sub-sample without any public funding (*PublicD*=0). However, the effect of *Adminsh* not only depends on whether or not NGOs rely on public funds, but also on the relative importance of public

[58] Figure 4.3a is based on column (4) of table 4.8; figure 4.3b is based on column (6) of table 4.8.



(a) Exit probability depending on *Adminsh* and *PublicD* (according to column 4 in table 4.8).



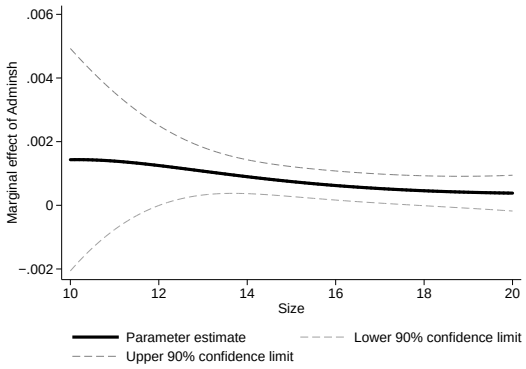
(b) Marginal effect of *Adminsh* on exit probability; conditional on *Publicsh* (according to column 6 in table 4.8).

Fig. 4.3: Non-linear effects, part I

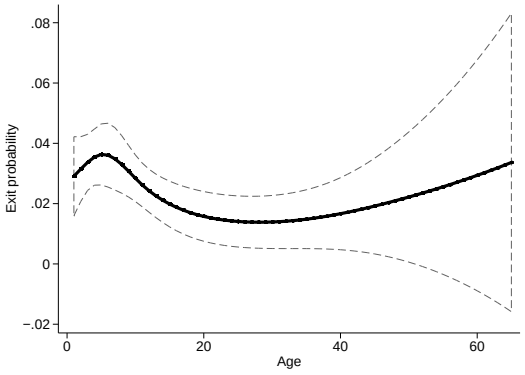
funding, as reflected in *Publicsh*, for those NGOs receiving any public funds. According to figure 4.3b, the marginal effect of *Adminsh* on the exit probability declines with higher values of *Publicsh*, but remains significantly positive for all values of *Publicsh* of up to 55 per cent. The effect loses significance beyond this threshold, i.e., for about 18 per cent of all observations.[59] The non-linearities revealed in figures 4.3a and 4.3b may be explained as follows. It can reasonably be assumed that mainly the official financiers engage in monitoring of NGOs.[60] Moreover, purely financial criteria of NGO behavior tend to play a larger role when it comes to 'upward accountability' of NGOs to state authorities (section 4.2). Inefficiency is thus more likely to be exposed in case of NGOs with public funding, and official financiers may put pressure on NGOs with larger administrative overhead to exit international development. However, the fairly weak USAID requirement for NGOs not to spend more than 40 per cent of total expenses on 'supporting services' may explain the modest increase of the exit probability with higher shares of administrative costs. Furthermore, the budget constraints of NGOs are increasingly relaxed with higher values of *Publicsh*, which could explain the declining marginal effects of *Adminsh* in figure 4.3b. In other words, the impact of softer budget constraints becomes more and more important, relative to the impact of official monitoring. An additional explanation of why official monitoring does not appear to be effective beyond the threshold of *Publicsh* in figure 4.3b could be that both *Adminsh* and *Publicsh* are relatively high when NGOs just entered in-

[59] The threshold in figure 4.3b is lower when the estimates are based on the extended period of observation, 1984-2009.

[60] Nunnenkamp and Öhler (2012b) show that private donors hardly make use of publicly available information on the administrative efficiency of NGOs when deciding on donations.



(a) Marginal effect of *Adminsh* on exit probability; conditional on *Size* (according to column 7 in table 4.8).



(b) Exit probability depending on *Age*; non-linear relationship (according to column 3 in table 4.9). Note: broken lines provide lower and upper 90% confidence limits.

Fig. 4.4: Non-linear effects, part II

ternational development activities. While program activities as well as alternative sources of financing have still to be developed, official financiers may provide feed money – instead of insisting on administratively efficient operations immediately after entry already. Another explanation might be that *Publicsh* exceeds the threshold for some fairly large NGOs in the sample. Similar to the "too big to fail"-argument in banking and finance, the threat of official financiers to enforce the exit of large and inefficient NGOs from international development activities may lack credibility.

The marginal effect of *Adminsh* conditional on *Size* in figure 4.4a, derived from the estimation in column (7) of table 4.8, fits into this pattern. As can be seen, the effect of *Adminsh* on the exit probability is significantly positive over the broad middle range of the size distribution. However, the effect loses significance at both ends of the size distribution. At the lower end, NGOs may not only be relatively small but also relatively new and inexperienced in international development. They may incur relatively high administrative costs during the initial phase of developing program activities. Probably, they await additional information indicating whether they are likely to grow and become more efficient before they decide on exit.[61] At the opposite end, the largest NGOs may be tempted to avoid exit especially when private as well as official donors tolerate administrative inefficiency.

Table 4.9 addresses non-linearities with regard to age and experience more systemati-

[61] However, the relatively small number of NGOs at the lower end of the size distribution may also be partially responsible for the insignificant marginal effect.

cally. Once again, the standard regressors (replicated in column 1) are hardly affected when considering different age groups in column (2) or splines in column (3). In column (2), the youngest NGO group represents the reference category.[62] Relative to the other age groups, the exit probability proves to be significantly higher (at the one per cent level) for the second group (3-5 years). In column (3) we replace the age group dummies with natural cubic splines as suggested by Beck et al. (1998). In this way we additionally capture non-linearities within intervals of the age distribution.[63] The graphical representation in figure 4.4b indicates that the exit probability decreases with age and experience after an initial peak at the lower end of the age distribution.[64] This closely resembles the results from the estimation with the different age groups. Hence, it is no longer surprising that *Age* proves to be insignificant when entered in linear form (column 1). The estimations reported in columns (4), (5) and (6) of table 4.9 point to strongly non-linear effects of the NGOs' administrative overhead on the probability of exit. In column (4), we exclude NGOs belonging to the lowest quintiles in terms of administrative costs and fundraising.[65] In this way, we may check whether it is only beyond a certain threshold that administrative costs are regarded by private donors and official financiers to be excessive and thus likely to increase the NGOs' exit probabilities. The results are very similar to those reported for the base-run in column (5) of table 4.4.[66] In other words, the results for the reduced sample underscore that exits are more likely for less efficient NGOs. However, we do not find evidence suggesting that the effect of *Adminsh* or Fundsh on the probability of exit is stronger for NGOs with 'unproductive' expenditures exceeding an indispensable minimum.

In columns (5) and (6), we classify all observations into five equally large sub-groups with increasing values of *Adminsh*, instead of using the continuous definition of *Adminsh*. The lowest quintile represents the reference category, and a dummy variable is set equal

[62] The five age groups are defined as follows: less or equal than 2 years, 3-5 years, 6-10 years, 11-20 years, and more than 20 years.

[63] We define five age intervals, divided by four so-called knots. The knots are located at the percentiles recommended in Harrell Jr. (2001, p. 23), i.e. the percentiles 5, 35, 65 and 95. The five age intervals translate into three spline parameters, the first of which represents the age of NGOs. From the estimates of these splines we can recover the non-linear effects of age on the exit probability. In principle, these non-linearities could also be captured by using a complete set of age dummies. However, we prefer splines, since we are losing less degrees of freedom and since the resulting representation of the non-linear effect of age on the exit probability is smooth.

[64] However, the initial peak disappears when the estimation is based on the extended period of observation.

[65] In unreported additional estimations, we excluded the lowest quintile with respect to either *Adminsh* or *Fundsh*. Results were very similar.

[66] However, they are not robust to extending the period of observation.

Tab. 4.9: Probit estimations, non-linear effects (administrative-cost quintiles, age group dummies and splines)

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Probit	probit	probit	probit	probit	probit
Size	-0.4291**	-0.4774**	-0.4630**	-0.5634**	-0.4216**	-0.4392**
	(0.1887)	(0.1928)	(0.1965)	(0.2466)	(0.1785)	(0.1863)
Size*2	0.0092	0.0109	0.0104	0.0135	0.0088	0.0094
	(0.0066)	(0.0067)	(0.0069)	(0.0086)	(0.0062)	(0.0065)
Fundsh	-0.0081	-0.0080	-0.0076	-0.0100	-0.0072	-0.0080
	(0.0073)	(0.0073)	(0.0074)	(0.0091)	(0.0074)	(0.0075)
Adminsh	0.0107**	0.0111***	0.0114***	0.0109**		
	(0.0042)	(0.0043)	(0.0042)	(0.0053)		
Adminsh dummies						
lower quintile					-0.0179	0.0043
					(0.1348)	(0.1369)
middle quintile					0.0859	0.1097
					(0.1306)	(0.1326)
upper quintile					0.0374	0.0656
					(0.1287)	(0.1299)
highest quintile					0.2377*	0.2667**
					(0.1299)	(0.1307)
Donationsh	-0.0009	-0.0011	-0.0008	-0.0009	-0.0012	-0.0011
	(0.0018)	(0.0018)	(0.0018)	(0.0021)	(0.0019)	(0.0018)
Publicsh	-0.0051**	-0.0053**	-0.0050**	-0.0061**	-0.0052**	-0.0053**
	(0.0022)	(0.0022)	(0.0022)	(0.0027)	(0.0022)	(0.0022)
Intfrac	-0.0055***	-0.0053***	-0.0053***	-0.0068***	-0.0056***	-0.0056***
	(0.0012)	(0.0012)	(0.0013)	(0.0015)	(0.0013)	(0.0012)
NGOdensity	0.0062	0.0061	0.0063	0.0041		0.0062
	(0.0050)	(0.0051)	(0.0051)	(0.0061)		(0.0051)
Herfin	-0.0097**	-0.0088**	-0.0092**	-0.0110**		-0.0095**
	(0.0042)	(0.0042)	(0.0043)	(0.0045)		(0.0042)
Age	-0.0605			-0.0746	-0.0699	-0.0597
	(0.0444)			(0.0532)	(0.0442)	(0.0445)
Age_group_2		0.3089***				
		(0.1110)				
Age_group_3		0.0040				
		(0.1243)				
Age_group_4		-0.0427				
		(0.1297)				
Age_group_5		-0.1438				
		(0.1781)				
Spline_1			0.0554			
			(0.0393)			
Spline_2			-2.4162*			
			(1.2373)			
Spline_3			3.7756**			
			(1.9048)			
Constant	3.0703**	3.1949**	3.0655**	4.5108**	2.6644**	3.2147**
	(1.4118)	(1.4363)	(1.4575)	(1.8538)	(1.3519)	(1.3893)
Observations	4,316	4,316	4,316	2,960	4,316	4,316

Reports the coefficients; for marginal effects, see the text. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level. Lowest quintile represents the reference category for *Adminsh* dummies.

to one for each of the remaining four quintiles. Surprisingly, three out of four dummy variables prove to be insignificant at conventional levels. *Adminsh* offers additional information beyond the traditional proxies of size and age only for the highest quintile with

particularly large administrative overhead.[67] The fact that administrative overheads are not associated with higher exit risks for the lower quintiles may reflect that headquarter services are needed at moderate levels for NGOs to operate effectively in the field (see section 4.2).

4.5 Conclusion

The recipients of NGO aid are interested in high and sustained project-related spending on the ground. Likewise, private donors dislike NGOs spending heavily on administration, management and fundraising. All the same, private donors do not appear to engage in effective screening of NGOs when deciding on where to donate (Nunnenkamp and Öhler, 2012b). Official financiers may be better prepared to monitor spending patterns of NGOs. On the other hand, the non-distribution constraint of NGOs may be weakened if public funding is readily available. Furthermore, NGO accountability has various dimensions extending beyond strictly financial and economic aspects, including social expectations and norms held in the relevant community. Hence, it is far from guaranteed that more efficient NGOs are more likely to survive in international development than their less efficient peers.

We employ probit estimations to analyze from an economic point of view which factors affect the probability of 'market' exit for almost 900 US based NGOs with overseas aid activities during the 1984-2005 period. To the best of our knowledge, the present study is the first to provide an empirical assessment of the links between the efficiency and survival of NGOs in international development. In addition to more traditional proxies of efficiency such as size and experience, we account for administrative overheads and fundraising as unproductive expenditures resulting in a higher efficiency price of NGO aid. Our focus is on the impact of administrative overheads, public funding and the interaction between these two factors on the survival probability of NGOs We also consider other aspects of NGO heterogeneity such as the type and field of activity of NGOs. We control for market characteristics such as the density of NGO operations and the concentration of resources. Our findings tend to support the notion of the liability of smallness and newness. The effects of NGO size on the probability of exit are more robust to extensions of the estimation equation than the effects of their age. Size and age have in common that the effects are non-linear. For instance, the exit probability decreases considerably when NGOs at the

[67] Our standard regressors are robust to this modification, too.

lower end of the size distribution grow larger, while this effect diminishes and eventually approaches zero when NGOs move up in the size distribution.

Expenditures for fundraising appear to be unrelated with NGO survival in international development. In contrast, we find a larger administrative overhead to be positively associated with NGO exit. However, NGO survival appears to be affected only when administrative overheads are particularly large. Public funding reduces the exit probability of NGOs by relaxing their budget constraints. It cannot necessarily be inferred that public funding keeps inefficient NGOs alive. To the contrary, it is only for publicly funded NGOs that administrative inefficiency is associated with a higher probability of exit. This finding may be attributed to official monitoring, but this effect weakens with increasing shares of public funding of NGOs. In other words, the impact of softer budget constraints becomes more and more important, relative to the impact of official monitoring.

Although we find some indications that the survival of NGOs in international development depends on financial efficiency, our analysis raises further questions to be addressed in future research. From an economic point of view, it deserves attention whether the governance and monitoring of NGOs could be improved to ensure the 'survival of the fittest'. Arguably, the predominance of private donations – in particular with a large number of small donors – weakens the incentive for effective monitoring of NGOs in the United States. At the same time, the monitoring of NGOs by official financiers might be improved. The links between financial efficiency and NGO survival could be strengthened if official financiers applied stricter rules and intensified the monitoring in line with the NGOs' reliance on public funds.

Governance and monitoring problems may be most difficult to overcome in the case of large, though inefficient NGOs. On the one hand, such NGOs may be tempted to avoid exit as long as private and official donors tolerate administrative inefficiency. On the other hand, effective monitoring may suffer from insufficient credibility once NGOs have grown 'too big to fail'. In addition, a broader set of unresolved questions refers to the relation between financial efficiency and non-financial aspects of NGO accountability. More importantly perhaps, future research shall address the possible conflicts between financial efficiency and the effectiveness of NGOs in helping resolve poverty-related problems in the recipient countries.

4.6 Appendix

Tab. 4.10: Robustness tests: accounting for 'classification error'

Variables	(1) probit	(2) probit	(3) probit	(4) probit	(5) probit	(6) probit
Size	-0.3558*	-0.3743*	-0.6546***	-0.6617***	-0.4692*	-0.4671*
	(0.2057)	(0.2145)	(0.2377)	(0.2357)	(0.2650)	(0.2651)
Size*2	0.0072	0.0078	0.0161*	0.0163*	0.0096	0.0095
	(0.0072)	(0.0075)	(0.0085)	(0.0084)	(0.0097)	(0.0097)
Age	-0.0534	-0.0417	0.0190	0.0261	0.0084	0.0169
	(0.0463)	(0.0466)	(0.0581)	(0.0583)	(0.0657)	(0.0654)
Fundsh	-0.0057	-0.0062	-0.0218**	-0.0222**	-0.0021	-0.0028
	(0.0078)	(0.0078)	(0.0099)	(0.0099)	(0.0109)	(0.0109)
Adminsh	0.0111**	0.0116**	0.0122**	0.0123**	0.0135**	0.0137**
	(0.0047)	(0.0047)	(0.0052)	(0.0052)	(0.0056)	(0.0056)
Donationsh	-0.0013	-0.0012	0.0037	0.0037	0.0036	0.0036
	(0.0020)	(0.0019)	(0.0025)	(0.0024)	(0.0029)	(0.0029)
Publicsh	-0.0052**	-0.0052**	-0.0010	-0.0011	0.0029	0.0028
	(0.0023)	(0.0023)	(0.0031)	(0.0031)	(0.0034)	(0.0034)
Intfrac	-0.0055***	-0.0055***	-0.0060***	-0.0060***	-0.0082***	-0.0081***
	(0.0014)	(0.0013)	(0.0017)	(0.0017)	(0.0019)	(0.0019)
NGOdensity		0.0095*		0.0069		0.0126
		(0.0056)		(0.0069)		(0.0091)
Herfin		-0.0092**		-0.0031		-0.0029
		(0.0047)		(0.0058)		(0.0051)
Constant	2.0712	2.6469*	0.6981	0.7043	-0.4770	-0.6338
	(1.5390)	(1.5862)	(1.6820)	(1.6243)	(1.8704)	(1.8830)
Observations	4,253	4,253	3,839	3,839	3,499	3,499

In this table we stepwise exclude NGOs where the exit status could not be verified with certainty based on additional data sources. We find that our main results also hold in specifications (5) and (6), where the risk of exit misclassification is small. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level.

Tab. 4.11: Probit estimations: sample split, religious vs. secular NGOs

	Religious NGOs			Secular NGOs		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	probit	probit	probit	probit	probit	probit
Size	-0.2573***	-0.5785	-0.6012	-0.1474***	-0.3889*	-0.3796*
	(0.0413)	(0.3826)	(0.3827)	(0.0267)	(0.1992)	(0.2014)
Size*2		0.0112	0.0120		0.0086	0.0082
		(0.0134)	(0.0134)		(0.0069)	(0.0070)
Age	0.0392	0.0257	0.0263	-0.0969*	-0.0960*	-0.0845*
	(0.0866)	(0.0877)	(0.0872)	(0.0510)	(0.0506)	(0.0514)
Fundsh	-0.0395***	-0.0394***	-0.0395***	0.0023	0.0012	0.0009
	(0.0141)	(0.0139)	(0.0140)	(0.0086)	(0.0085)	(0.0086)
Adminsh	0.0062	0.0065	0.0070	0.0108**	0.0110**	0.0116**
	(0.0087)	(0.0087)	(0.0087)	(0.0048)	(0.0049)	(0.0049)
Donationsh	0.0068	0.0071*	0.0068	-0.0023	-0.0021	-0.0019
	(0.0043)	(0.0042)	(0.0042)	(0.0021)	(0.0021)	(0.0020)
Publicsh	0.0021	0.0027	0.0023	-0.0061**	-0.0060**	-0.0059**
	(0.0061)	(0.0059)	(0.0058)	(0.0024)	(0.0024)	(0.0024)
Intfrac	-0.0091***	-0.0089***	-0.0089***	-0.0046***	-0.0046***	-0.0046***
	(0.0027)	(0.0027)	(0.0027)	(0.0014)	(0.0014)	(0.0014)
NGOdensity			0.0020			0.0101
			(0.0071)			(0.0088)
Herfin			-0.0034			-0.0130***
			(0.0063)			(0.0047)
Constant	1.5614*	3.8540	4.2336	1.1342**	2.7810*	3.2149**
	(0.9469)	(2.8182)	(2.7296)	(0.5562)	(1.4626)	(1.4928)
Observations	1,169	1,169	1,169	3,029	3,029	3,029

Reports the coefficients; for marginal effects, see the text. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level.

Tab. 4.12: Complementary log-log and IV probit models

Variables	cloglog			IV probit		
	(1)	(2)	(3)	(4)	(5)	(6)
Size	-0.2905***	-0.4153	-0.4009	-0.1097***	-0.6427**	-0.6819**
	(0.0446)	(0.3325)	(0.3401)	(0.0313)	(0.3157)	(0.3190)
Size*2		0.0030	0.0024		0.0165	0.0177*
		(0.0122)	(0.0125)		(0.0104)	(0.0106)
Age	-0.2259***	-0.1220	-0.1005	-0.3170***	-0.2418***	-0.2245***
	(0.0877)	(0.0890)	(0.0883)	(0.0796)	(0.0841)	(0.0848)
Fundsh	-0.0048	-0.0130	-0.0140	-0.0022	-0.0132	-0.0126
	(0.0145)	(0.0143)	(0.0143)	(0.0110)	(0.0125)	(0.0126)
Adminsh	0.0216***	0.0171**	0.0183**	0.0076	0.0034	0.0039
	(0.0077)	(0.0079)	(0.0077)	(0.0083)	(0.0094)	(0.0095)
Donationsh		-0.0021	-0.0016		-0.0025	-0.0022
		(0.0035)	(0.0035)		(0.0033)	(0.0033)
Publicsh		-0.0104**	-0.0103**		-0.0064*	-0.0065*
		(0.0046)	(0.0046)		(0.0035)	(0.0035)
Intfrac		-0.0107***	-0.0108***		-0.0061***	-0.0061***
		(0.0025)	(0.0025)		(0.0019)	(0.0020)
NGOdensity			0.0133			0.0133*
			(0.0106)			(0.0080)
Herfin			-0.0202**			-0.0112*
			(0.0094)			(0.0062)
Constant	0.0197	2.2032	2.9893	-2.9786	2.1931	2.5100
	(1.2787)	(2.5477)	(2.5560)	(239.2772)	(163.5393)	(164.5876)
Wald test of exog. (p-val.)				0.6201	0.8196	0.7846
Observations	4,319	4,316	4,316	2,856	2,852	2,852

Reports the coefficients. All estimations include year fixed effects as well as NGO-type fixed effects that are not shown. Standard errors are clustered at the NGO level. *** (**; *) denote significance at the one (five; ten) per cent level. Instruments are the level of *Size*,*Size*2*, *Fundsh*, *Adminsh*, *Donationsh*, *Publicsh*, and *Intfrac*, lagged by 2 and 3 periods.

Tab. 4.13: Definition of variables

Variable	Definition
Size	Total expenditures of NGO_i in year t-1; logged
Size*2	Size squared
Age	Number of years since NGO_i registered with USAID; alternative measure: number of years since NGO_i's foundation; logged
Fundsh	Expenses for fundraising of NGO_i in year t-1; share in total expenditures; if the database does not report a positive entry for fundraising in a particular year, the observation is considered to be missing; alternatively, we set fundraising to zero and include these observations; see text for details
Adminsh	Expenses for administration and management of NGO_i in year t-1; share in total expenditures
Donationsh	Private donations to NGO_i in year t-1; share in total revenues
Publicsh	Public funding of NGO_i in year t-1; share in total revenues; public funding includes funds from USAID, other US government sources, foreign governments and international organizations
Intfrac	Share of expenditures spent for international development cooperation in total (program-related) expenditures; note that various NGOs in the sample are active in both overseas programs and domestic programs within the United States; range from 0 to 100, with higher values reflecting a higher share of overseas programs in overall program expenditure
NGOdensity	Number of NGOs in the sample being active in the same sub-group as NGO_i; sub-groups relate to different religious affiliations in the case of religious NGOs, and to different fields of activity in the case of secular NGOs; see text for details
Herfin	Herfindahl index reflecting the concentration of resources (total revenues) among NGOs belonging to the same sub-group, as defined above; higher index values reveal more concentrated resources

Note: the database collected by Rachel McCleary is the source of all variables listed; *NGOdensity* and *Herfin* are based on own calculations

4.7 Bibliography

Ai, Chunrong and Edward C. Norton, "Interaction Terms in Logit and Probit Models," *Economics Letters*, 2003, *80* (1), 123–129.

Aldashev, Gani and Thierry Verdier, "Goodwill Bazaar: NGO Competition and Giving to Development," *Journal of Development Economics*, 2010, *91* (1), 48–63.

Audretsch, David B. and Talat Mahmood, "New Firm Survival: New Results Using a Hazard Function," *The Review of Economics and Statistics*, 1995, *77* (1), 97–103.

Bandick, Roger, "Multinationals and Plant Survival," *Review of World Economics*, 2010, *146* (4), 609–634.

Beck, Nathaniel, Jonathan N. Katz, and Richard Tucker, "Taking Time Seriously: Time-Series-Cross-Section Analysis with a Binary Dependent Variable," *American Journal of Political Science*, 1998, *42* (4), 1260–1288.

Bernard, Andrew B. and J. Bradford Jensen, "Firm Structure, Multinationals, and Manufacturing Plant Deaths," *The Review of Economics and Statistics*, 2007, *89* (2), 193–204.

Bloodgood, Elizabeth A., "INGO Population Ecology: Isomorphism among International NGOs?," Paper prepared for the Annual Convention of the International Studies Association, Montreal 2011.

__ **and Emily Clough**, "The Dynamics of NGO Death," Paper for presentation at the International Studies Association Annual Conference, New Orleans 2010.

__ **and Joannie Tremblay-Boire**, "International NGOs and National Regulation in an Age of Terrorism," *Voluntas*, 2011, *22* (1), 142–173.

__ **,** __ **, and Aseem Prakash**, "National Styles of NGO Regulation," mimeo, Concordia University, Montreal, and University of Washinton, Seattle 2010.

Brakman Reiser, Dana, "Filling the Gaps in Nonprofit Accountability: Applying the Club Perspective in the US Legal System," in Mary K. Gugerty and Aseem Prakash, eds., *Voluntary Regulation of NGOs and Nonprofits*, Cambridge: Cambridge University Press, 2010, pp. 41–63.

Castaneda, Marco A., John Garen, and Jeremy Thornton, "Competition, Contractibility, and the Market for Donors to Nonprofits," *Journal of Law, Economics and Organization*, 2008, *24* (1), 215–246.

Clementi, Gina L. and Hugo A. Hopenhayn, "A Theory of Financing Constraints and Firm Dynamics," *The Quarterly Journal of Economics*, 2006, *121* (1), 229–265.

Cooley, Alexander and James Ron, "The NGO Scramble: Organizational Insecurity and the Political Economy of Transnational Action," *International Security*, 2002, *27* (1), 5–39.

Deily, Mary E., Niccie L. McKay, and Fred H. Dorner, "Exit and Inefficiency: The Effects of Ownership Type," *Journal of Human Resources*, 2000, *35* (4), 734–747.

DiMaggio, Paul J., "The New Institutionalisms: Avenues of Collaboration," *Journal of Institutional and Theoretical Economics*, 1998, *154* (4), 696–705.

__ **and Walter W. Powell**, "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields," *American Sociological Review*, 1983, *48* (2), 147–160.

Disney, Richard, Jonathan Haskel, and Ylva Heden, "Entry, Exit and Establishment Survival in UK Manufacturing," *Journal of Industrial Economics*, 2003, *51* (1), 91–112.

Dreher, Axel, Peter Nunnenkamp, Hannes Öhler, and Johannes Weisser, "Financial Dependence and Aid Allocation by Swiss NGOs: A Panel Tobit Analysis," *Economic Development and Cultural Change*, 2012, *60* (4), 829–867.

Dunne, Timothy, Mark J. Roberts, and Larry Samuelson, "The Growth and Failure of U.S. Manufacturing Plants," *The Quarterly Journal of Economics*, 1989, *104* (4), 671–98.

Ebrahim, Alnoor, "Accountability in Practice: Mechanisms for NGOs," *World Development*, 2003, *31* (5), 813–829.

__ , "Accountability Myopia: Losing Sight of Organizational Learning," *Nonprofit and Voluntary Sector Quarterly*, 2005, *34* (1), 56–87.

__ , "The Many Faces of Nonprofit Accountability," Working Paper 10-069, Harvard Business School, Cambridge, MA. 2010.

Eckerd, Adam and Stephanie Moulton, "Heterogeneous Roles and Heterogeneous Practices: Understanding the Adoption and Uses of Nonprofit Performance Evaluations," *American Journal of Evaluation*, 2011, *32* (1), 98–117.

Edwards, Michael and David Hulme, "Too Close for Comfort? The Impact of Official Aid on Nongovernmental Organizations," *World Development*, 1996, *24* (6), 961–973.

Evans, David S., "The Relationship between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries," *Journal of Industrial Economics*, 1987, *35* (4), 567–81.

Fernandez, Juan J., "Causes of Dissolution among Spanish Nonprofit Associations," *Nonprofit and Voluntary Sector Quarterly*, 2008, *37* (1), 113–137.

Fowler, Alan, "Assessing NGO Performance: Difficulties, Dilemmas and a Way Ahead," in Michael Edwards and David Hulme, eds., *Non-Governmental Organisations: Performance and Accountability: Beyond the Magic Bullet*, London: Earthscan Publications, 1995, pp. 143–156.

Freeman, John, Glenn R. Carroll, and Michael T. Hannan, "The Liability of Newness: Age Dependence in Organizational Death Rates," *American Sociological Review*, 1983, *48* (5), 692–710.

Glaeser, Edward L. and Andrei Shleifer, "Not-for-Profit Entrepreneurs," *Journal of Public Economics*, 2001, *81* (1), 99–115.

Görg, Holger and Eric Strobl, ""Footloose" Multinationals?," *Manchester School*, 2003, *71* (1), 1–19.

__ **and Marina-Eliza Spaliara**, "Financial Health, Exports, and Firm Survival: Evidence from UK and French Firms," *Economica*, in press.

Gugerty, Mary K., "Signaling Virtue: Voluntary Accountability Programs among Nonprofit Organizations," *Policy Sciences*, 2009, *42* (3), 243–273.

__ **and Aseem (eds.) Prakash**, *Voluntary Rgulation of NGOs and Nonprofits*, Cambridge, MA: Cambridge University Press, 2010.

Hansmann, Henry B., "The Role of Nonprofit Enterprise," *The Yale Law Journal*, 1980, *89* (5), 835–901.

Harrell Jr., Frank E., *Regression Modeling Strategies: With Applications to Linear Models, Logistic Regression, and Survival Analysis*, New York: Springer, 2001.

Harrison, Teresa D. and Christopher A. Laincz, "Entry and Exit in the Nonprofit Sector," *The B.E. Journal of Economic Analysis & Policy*, 2008, *8* (1), 1–42.

Hess, Wolfgang and Maria Persson, "The Duration of Trade Revisited," *Empirical Economics*, 2012, *43* (3), 1083–1107.

Holmes, Phil, Andrew Hunt, and Ian Stone, "An Analysis of New Firm Survival Using a Hazard Function," *Applied Economics*, 2010, *42* (2), 185–195.

Hulme, David and Edwards Michael, "NGOs, States and Donors: An Overview," in David Hulme and Michael Edwards, eds., *NGOs, States and Donors: Too Close for Comfort?*, Basingstoke: Macmillan Press, 1997, pp. 3–22.

Jordan, Lisa, "Mechanisms for NGO Accountability," Research Paper Series 3, Global Public Policy Institute, Berlin 2005.

__ **and Peter van Tuijl**, "Rights and Responsibilities in the Political Landscape of NGO Accountability: Introduction and Overview," in Lisa Jordan and Peter van Tuijl, eds., *NGO Accountability: Politics, Principles and Innovations*, London: Earthscan, 2007, pp. 2–30.

Jovanovic, Boyan, "Selection and the Evolution of Industry," *Econometrica*, 1982, *50* (3), 649–70.

Khanna, Jyoti and Todd Sandler, "Partners in Giving: The Crowding-in Effects of UK Government Grants," *European Economic Review*, 2000, *44* (8), 1543–1556.

Koch, Dirk-Jan, Axel Dreher, Peter Nunnenkamp, and Rainer Thiele, "Keeping a Low Profile: What Determines the Allocation of Aid by Non-Governmental Organizations?," *World Development*, 2009, *37* (5), 902–918.

Lakdawalla, Darius and Tomas Philipson, "The Nonprofit Sector and Industry Performance," *Journal of Public Economics*, 2006, *90* (8-9), 1681–1698.

Lecy, Jesse, "Sector Density, Donor Policy, and Organizational Demise: A Population Ecology of International Nonprofits," Paper presented at the International Studies Association Conference, Montreal 2011.

__ **, Hans P. Schmitz, and Haley Swedlund**, "Non-Governmental and Not-for-Profit Organizational Effectiveness: A Modern Synthesis," *Voluntas*, 2012, *23* (2), 434–457.

Mata, José and Pedro Portugal, "Life Duration of New Firms," *Journal of Industrial Economics*, 1994, *42* (3), 227–245.

__ **and** __ , "The Survival of New Domestic and Foreign-Owned Firms," *Strategic Management Journal*, 2002, *23* (4), 323–343.

McCleary, Rachel M. and Robert J. Barro, "Private Voluntary Organizations Engaged In International Assistance, 1939-2004," *Nonprofit and Voluntary Sector Quarterly Journal*, 2008, *37* (3), 512–536.

McCoskey, Suzanne, "NGOs In the Aid Community: Do Funding Source or Economic Conditioning Matter to Decisions of Country or Activity Involvement?," *Journal of Humanitarian Assistance.*, 2009.

Moulton, Stephanie and Adam Eckerd, "Preserving the Publicness of the Nonprofit Sector: Resources, Roles, and Public Values," *Nonprofit and Voluntary Sector Quarterly*, 2012, *41* (4), 656–685.

Musso, Patrick and Stefano Schiavo, "The Impact of Financial Constraints on Firm Survival and Growth," *Journal of Evolutionary Economics*, 2008, *18* (2), 135–149.

Nonprofit Overhead Cost Project, "Getting What We Pay for: Low Overhead Limits Nonprofit Effectiveness," Brief 3, Urban Institute and Indiana University 2004.

__ , "The Pros And Cons of Financial Efficiency Standards," Brief 5, Urban Institute and Indiana University 2004.

Nunnenkamp, Peter and Hannes Öhler, "Funding, Competition and the Efficiency of NGOs: An Empirical Analysis of Non-Charitable Expenditure of US NGOs Engaged in Foreign Aid," *Kyklos*, 2012, *65* (1), 81–110.

__ **and** __ , "How to Attract Donations: The Case of US NGOs in International Development," *The Journal of Development Studies*, 2012, *48* (10), 1522–1535.

Powell, Walter W. and Paul J. DiMaggio, *The New Institutionalism in Organizational Analysis*, Chicago and London: University of Chicago Press, 1991.

Prakash, Aseem and Mary K. Gugerty, "Conclusions: Nonprofit Accountability Clubs," in Aseem Prakash and Mary K. Gugerty, eds., *Voluntary regulation of NGOs and nonprofits*, Cambridge: Cambridge University Press, 2010, pp. 283–302.

__ **and** __ , "Trust But Verify? Voluntary Regulation Programs In The Nonprofit Sector," *Regulation & Governance*, 2010, *4* (1), 22–47.

Reid, Elizabeth J. and Janelle A. Kerlin, "The International Charitable Nonprofit Subsector in the United States: International Understanding, International Development and Assistance, and International Affairs," Technical Report, The Urban Institute, Washington, DC. 2006.

Ribar, David C. and Mark O. Wilhelm, "Altruistic and Joy-of-Giving Motivations in Charitable Behavior," *Journal of Political Economy*, 2002, *110* (2), 425–457.

Rose-Ackerman, Susan, "Charitable Giving and "Excessive" Fundraising," *The Quarterly Journal of Economics*, 1982, *97* (2), 193–212.

Strang, David and John W. Meyer, "Institutional Conditions for Diffusion," *Theory and Society*, 1993, *22* (4), 487–511.

Szper, Rebecca and Aseem Prakash, "Charity Watchdogs and the Limits of Information-Based Regulation," *Voluntas*, 2011, *22* (1), 112–141.

Twombly, Eric C., "What Factors Affect the Entry and Exit of Nonprofit Human Service Organizations in Metropolitan Areas?," *Nonprofit and Voluntary Sector Quarterly*, 2003, *32* (2), 211–235.

Wagner, Joachim, "The Post-Entry Performance of New Small Firms in German Manufacturing Industries," *Journal of Industrial Economics*, 1994, *42* (2), 141–54.

Wollebaek, Dag, "Survival in Local Voluntary Associations," *Nonprofit Management and Leadership*, 2009, *19* (3), 267–284.

Wooldridge, Jeffrey M., *Econometric Analysis Of Cross Section And Panel Data*, Cambridge, MA: MIT Press, 2002.

Zingales, Luigi, "Survival of the Fittest or the Fattest? Exit and Financing in the Trucking Industry," *Journal of Finance*, 1998, *53* (3), 905–938.

Eidesstattliche Erklärung:

Ich erkläre hiermit an Eides Statt, dass ich meine Doktorarbeit “Essays on Offshoring and on Determinants of NGO Survival” selbständig und ohne fremde Hilfe angefertigt habe und dass ich alle von anderen Autoren wörtlich übernommenen Stellen, wie auch die sich an die Gedanken anderer Autoren eng anlehnenden Ausführungen meiner Arbeit, besonders gekennzeichnet und die Quellen nach den mir angegebenen Richtlinien zitiert habe.

Kiel, September 2013

Tillmann Schwörer