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The effect of international tax competition on the relative performance of multinational enterprises and domestic firms

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Abstract: This study aims to identify and quantify the impact of international tax competition on the competition between multinational enterprises and domestic firms in several European countries. To this end, this study identifies a competitive advantage that multinationals hold over domestic firms. A competitive advantage that is obtained by multinationals because these enterprises are able to use international tax competition to lower their overall tax burden, something firms that operate exclusively domestically are not able to do. A simple linear regression finds a negative and statistically significant relation between the performance of multinationals and domestic firms, indicating that domestic firms are indeed at a structural disadvantage in their competition with multinationals. However, a lack of detailed firm level data means that the identified negative relation between the two types of firms cannot be exclusively attributed to the effect of international tax competition. This study therefore provides no conclusive evidence for the negative impact of international tax competition on competition between multinationals and domestic firms, but should be seen as an introductory research into this relation.

Keywords: tax avoidance, competition, tax havens

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1. Introduction

In November 2014, the International Consortium of Investigative Journalists (ICIJ) publicised hundreds of leaked, privately negotiated advance tax agreements (ATAs) (Marian, 2017). These ATAs were issued to primarily multinational enterprises (MNEs) by Luxembourg's Inland Revenue, and allowed these MNEs to severely decrease their overall tax payments. The administrative practises revealed in the leaked documents not only offered MNEs a favourable local tax regime, but allowed them to erode their tax base in jurisdictions other than Luxembourg. Marian describes the administrative practises of Luxembourg's Inland Revenue as a tax avoidance service, which seems to be aimed at attracting revenue rather than any real investment.

The leaked tax agreements describe a widespread form of tax competition, where national governments compete by offering favourable tax treatment in order to attract economic activity. And although Luxembourg has the reputation of being a tax haven, it is not the only country taking part in this phenomenon. Since June 2013, the European Commission has been investigating the tax ruling practises of member states. Under the EU state aid rules, tax agreements like those issued in Luxembourg are seen as a form of illegal state aid. The investigations by the European Commission led to a ruling in August 2016, stating that Apple has received undue tax benefits from the Irish government worth up to €13 billion (European Commission, 2016). An agreement between Apple and the Irish government had allowed the company to pay substantially less tax than other businesses. In fact, the commission calculated that this selective treatment allowed Apple to pay an effective corporate tax rate of one percent on its European profits in 2003. Towards 2014, this percentage decreased even further to 0.005 percent. Other deals investigated by the European Commission include Fiat and Starbucks, which were ordered to pay back €20 - €30 million each in unpaid taxes to Luxembourg and the Netherlands respectively (European Commission, 2015). The commission argued that these companies had unduly shifted profits without economic justification to reduce the tax paid by the company. More recently, Amazon was also accused of receiving preferential tax treatment from the Luxembourg government. The company paid four times less tax than other local companies subject to the same national tax rules (European Commission, 2017). The value of this benefit granted to Amazon was calculated by the commission to be around €250 million, plus interest.

The leaking of Luxembourg's ATAs and the investigations of the European Commission signal an issue of widespread tax avoidance by MNEs. Since the agreements between companies and national governments seem to be mostly reserved for MNEs, it can be argued that such agreements offer these enterprises an advantage over domestically operating enterprises. The aim of this study is to determine whether MNEs indeed enjoy such a tax induced competitive advantage, and to measure the effect of this competitive advantage

on a country's domestic firms. This study can thus be summarised in the following research question: "*Do MNEs enjoy a tax induced competitive advantage over domestic firms, and to which extend does this competitive advantage affect the performance of domestic firms?*". In addition to proposing an answer to the research question, this study emphasises how tax competition not only affects the parties that engage in tax avoidance practises, but also disrupts the economy through distorted competition and foregone tax revenue. This study thereby draws attention to a policy issue of an international scale.

This paper is divided into six sections, including this introduction. Section 2 below gives an overview of the relevant academic literature and provides the theoretical framework of this study. This section introduces this theoretical framework by explaining the mechanisms behind tax competition on a macroeconomic level. Also, section 2 introduces several tax avoidance tools that are used by firms to lower their tax burden by shifting resources between countries with different tax regimes. This second section concludes with an overview of the empirical and anecdotal evidence of the extent to which firms use such tax avoidance strategies. Section 3 discusses the data used in this study. The sources used to construct a dataset are considered, and the quality of the data is assessed in terms of its validity, representativity and reliability. Section 4 describes the methodology of this study, introducing the economic models that are used to empirically test the theoretical predictions outlined in section 2. The results of the empirical analysis are described in section 5. This section summarises the most important regression results and relates these results to the literature outlined in section 2. Finally, section 6 summarises the study and reflects on the extent to which research objectives are fulfilled. This section also discusses the practical implications of the results and proposes a suggestion for further research.

2. Literature

This study attempts to measure the effects of tax competition on the competition between MNEs and domestically operating companies.[1] In this sense, the focus of this research lies on measuring the effect of a competitive advantage one group of firms has over another, rather than tax competition itself. Nevertheless, a comprehension of the forces that drive and steer tax competition is essential in understanding the theoretical foundation behind this study. To this end, this section provides an overview of the central mechanisms that determine the extent of tax competition. This section is divided into three subsections. Section 2.1 considers the theory on tax competition on a macroeconomic level, thereby providing a context in which the relation between MNEs and domestic firms should be regarded. Section 2.2 describes the implications of tax competition at the firm level, explaining how MNEs benefit

[1] Within the context of this study, a firm is considered to be operating domestically when it has a legal presence only in its home country. Domestically operating firms may engage in the import and export of goods and services however.

from inter-country differences in tax regimes and how this affects domestic firms. This section concludes with a theoretical prediction that explains how tax competition distorts competition by allowing MNEs to obtain a competitive advantage over domestic firms. Finally, section 2.3 summarises the empirical literature on international tax competition in order to support the theoretical framework outlined in sections 2.1 and 2.2.

2.1. *The theory of tax competition*

The first step in explaining tax competition is to provide an appropriate definition. In this study, a definition provided by Wilson and Wildasin (2004, p. 1067) will be adopted. This definition describes tax competition as "*noncooperative tax setting by independent governments, under which each government's policy choices influence the allocation of a mobile tax base among regions represented by these governments*." This definition accurately captures the phenomenon outlined in the introduction, as it encompasses horizontal tax competition models. In horizontal models, governments at the same level (e.g. federal, state or local) are competing for mobile factors of production. In the context of this study this definition thus captures the competition for capital, which is perceived to be mobile, between national governments. With an appropriate definition in place, the main mechanisms behind tax competition can be summarised. Wilson and Wildasin (2004) provide a comprehensive overview of the literature on tax competition, and highlight this phenomenon from multiple perspectives. Several of the key issues raised in this study are discussed in turn below. Together, the definition and mechanisms provide a theoretical basis on which the subsequent sections can build.

First, one of the most prominent implications of tax competition is perhaps its effect on firm location. Perhaps unsurprisingly, firms react to tax competition by relocating to the jurisdiction with the most favourable tax regime. The process of relocating for tax purposes is considered as tax avoidance which, in contrast to tax evasion, is not illegal.[2] Although tax avoidance may not seem beneficial from the perspective of countries experiencing an outflow of firm activity, this practise should not be harmful in theory. According to Wilson and Wildasin (2004), the relocation of firms in response to taxation should lead to governments tailoring their taxes and expenditures to the preference of these firms, resulting in an equilibrium where firms are taxed at the rate that reflects the cost of providing public inputs. From this perspective, tax competition is just another form of competition that leads to a general equilibrium among the competing governments. A critical requirement for this

[2] The OECD defines tax **avoidance** as "*the arrangement of a taxpayer's affairs that is intended to reduce his tax liability and although the arrangement could strictly be legal it is usually in contradiction with the intent of the law it purports to follow"* (OECD, 2018). Tax **evasion** on the other hand, is defined as "*illegal arrangements where liability to tax is hidden or ignored, i.e. the taxpayer pays less tax than he is legally obligated to pay by hiding income or information from the tax authorities*"

theory to hold however, is that the tax on a unit of investment should equal the cost incurred by a government in providing the public goods. In other words, public goods should be priced according to their marginal cost.

The second implication relates to the size of the government. In tax competition literature, the consensus seems to be that tax competition lowers taxes and government spending to below their efficient levels. An extensively used model that illustrates this notion is the Zodrow-Mieszkowski model (Zodrow and Mieszkowski, 1986). In short, this model assumes a world with a fixed number of identical regions and a fixed capital supply. There are two factors of production, capital and labour, which are mobile and immobile respectively. Finally, a tax on all capital within a region's borders is used to finance the production of public goods. A key takeaway of this model is the notion of a fiscal externality. As the total supply of capital is fixed, one region raising the capital tax induces a capital outflow from this region into the remaining regions. A region raising its tax rate thus imposes a positive externality on other regions. Similarly, a region lowering its tax rate imposes a negative externality on other regions. The Zodrow-Mieszkowski model essentially describes tax competition as a race to the bottom, where governments compete in a Nash game for a fixed pool of investments by constantly lowering their tax rate relative to each other. The result is an equilibrium tax rate that lies below its efficient level, resulting in a loss of tax revenue to governments.

Thirdly, it is important to stress that tax competition does not just involve the adjustment of overall tax rates. There is an important distinctions between tax rates on different factors of production. A critical factor in this distinction is the mobility of different factors, which in turn affects their elasticities with respect to taxation. Capital tends to be more mobile across regions than labour, which means that it can react to higher taxes by relocating. Due to its mobility, capital is more elastic with respect to taxation compared to labour. This incentivises governments to reduce taxation on capital, and raise taxes on labour. Taxing the elastic factor relatively heavy would be inefficient, as it would simply lead to an outflow of capital. The difference in mobility across production factors is included in models such as the Zodrow-Mieszkowski model, which distinguishes between mobile capital and immobile labour.

A final factor that should be considered is the importance of region size. More specifically, the asymmetric effect of tax competition on regions with different sizes in terms of population. Wilson and Wildasin (2004) state that smaller regions set lower tax rates than larger regions, as the former are characterised by higher capital elasticities. This notion is built on an analysis of asymmetric tax competition by Bucovetsky (1991) and Wilson (1991). The result is a misallocation of capital across region, and the emergence of small regions as tax havens. The relation between region size and tax regime makes sense intuitively,

considering the fact that most states that have a reputation of being a tax haven (the Cayman Islands, Malta, Luxembourg, to name a few) tend to be small in population size.

To summarise, tax competition is a practise where governments at the same level (in the context of this study, a national level) compete for capital, which is mobile across regions. In order to avoid taxes firms then reallocate to regions with attractive tax regimes, which leads to a flow of investments to these regions. Tax competition can have a profound effect on both the allocation of firms across regions and the size of governments that engage in this competition. Furthermore, the mobile nature and high elasticity of capital shifts the burden of taxation towards labour. And because the elasticity of capital differs with region size, smaller regions are more likely to offer a favourable tax regime.

2.2. *Tax competition on a firm level*

Section 2.1 approached the phenomenon of tax competition from a macroeconomic perspective, focusing the regional distribution of firms and the effects on governments. This section adopts a more micro-oriented view and considers the practical implications of tax competition from the perspective of the tax avoiding firm. More specifically, this section focuses on the behaviour of MNEs under international tax competition. The focus on MNEs is based on the notion that only this type of organisation is able to use international tax competition to its advantage and lower its overall tax burden. This assumption is based on the reasoning that firms react to differences in national tax regimes by relocating their resources across borders. Such a shift of resources requires a legal presence in the country to which resources are shifted. In other words, an MNE's international presence allows it to benefit from international tax competition, in contrast to firms that operate exclusively domestically. This reasoning seems to be confirmed by the fact that the majority of Luxembourg tax deals leaked by the ICIJ, as well as the European Commission investigations mentioned in the introduction, refer to MNEs. The remainder of this section explains how MNEs use their international presence to lower their overall tax burden. First, a definition of the term MNE is given, and several assumptions are introduced regarding the behaviour of firms in the context of tax competition. Second, the two main tools used by the tax avoiding MNE are introduced, namely the firms' use of transfer prices and internal debt structures. Finally, this section summarises the main implications of the behaviour of the tax avoiding firm in the context of this study. More specifically, this summary explains the effect of tax avoidance by MNEs on the nature of competition at the national level.

MNE is a rather broad term used to describe firms with a strong international presence. There is no single generally accepted definition of the type of firm that can be characterised as an MNE. In order to provide some clarity on what is considered an MNE in the context of this study, a definition provided by the OECD (2008, p. 12) will be adopted.

This definition describes MNEs as "*companies or other entities established in more than one country and so linked that they may co-ordinate their operations in various ways. While one or more of these entities may be able to exercise a significant influence over the activities of others, their degree of autonomy within the enterprise may vary widely from one multinational enterprise to another. Ownership may be private, state or mixed*". This definition is still far from specific, as it does not distinguish different forms of ownership or management, for example. However, this definition is appropriate in the context of this study for two main reasons. First, the data used for the empirical part of this paper are drawn from the OECD database, which means that data on MNEs is generated under an OECD definition. Adopting the OECD definition in the theoretical section of this study therefore ensures consistency in the definitions used throughout the different sections. The second reason is that this definition, although rather broad, is adequate for the purpose it serves. This study is based on the notion that MNEs benefit from international tax competition, in contrast to firms that operate exclusively domestically, due to their international presence. The definition introduced above captures this distinction, and thereby provides an appropriate explanation of what is considered an MNE within the confines of this study. Furthermore, the assumption of the profit maximising firm will be adopted. In the context of this study this implies that all firms, both MNEs and domestic firms, will aim to minimise their cost of capital by minimising the tax burden. For domestic firms, this means that they simply adhere to the tax regime in their country of residence, as they are not able to shift resources to a foreign subsidiary. For MNEs, this means that they will shift their resources globally in such a way that they minimise their overall tax burden.

MNEs have two main tools at their disposal they can use to minimise their tax burden: transfer prices and internal debt structures. The main idea behind such tools is that they allow MNEs to inflate profits in one country and erode them in another, by shifting resources between its subsidiaries in these countries. Profits are shifted in such a way that they are concentrated in countries that offer low taxes and drawn from countries with high taxes. These two tools will be explained in turn below, starting with the use of transfer prices.

Transfer prices refer to the prices used to value an organisation's internal transactions, the transactions that incorporate the sale of goods and services between entities within a larger organisation. Transfer prices are determined by an appropriate allocation of (overhead) costs to the goods and services sold internally, meaning that they are the result of accounting practises rather than market forces. By manipulating these prices, MNEs can artificially raise or lower profits of particular entities (Sikka and Willmott, 2010). To illustrate, consider the example of an MNE with two subsidiaries, A and B. These subsidiaries are located in separate countries and therefore face different tax rates. To shift profits between subsidiaries, A sells goods to B at an inflated transfer price, reducing the profits of B

while increasing the profits of A. The MNE's profits are now concentrated in subsidiary A. As long as subsidiary A faces lower tax rates than B, this transfer pricing strategy decreases the overall tax burden of the MNE. Transfer prices are a suitable tool in tax avoidance because these prices are not determined by market forces. This makes the determination of a reasonable transfer price highly subjective, which in turn makes it difficult for authorities to detect and correct manipulated transfer prices (Keuschnigg and Devereux, 2013; Sikka and Willmott, 2010). A method that is often used to identify manipulated transfer prices is to compare them to the arm's length price: the price of the transaction would it have been a market transaction. If the transfer price is judged to be significantly different from the arm's length price, it will be corrected by the national tax authorities (Yao, 2013). However, the lack of market prices makes it difficult to estimate a reasonable arm's length price, meaning that manipulated transfer prices often remain undetected.

The second tool employed by MNEs to lower their tax burden is the use of internal debt structures. With this profit shifting technique, MNE affiliates in countries with high tax rates borrow from affiliates located in countries with low tax rates. This internal borrowing allows the affiliates that face high taxes to reduce their taxable profits by deducting interest payments. These interest payments flow to the affiliate in the country with low tax rates, where they are then taxed as earnings (Buettner and Wamser, 2013). What the two tax avoiding tools explained above have in common, is the fact that they are not illegal in principle. Although resources are shifted between subsidiaries with no other reason than to lower a company's taxable income, profits are not hidden from tax authorities. The manipulation of transfer prices and internal debt structures may conflict with the intent of the law, but it does not necessarily violate it. This ambiguity is captured by the distinction between tax avoidance and tax evasion, explained in section 2.1.

In sum, this subsection explained the different tools MNEs have at their disposal to lower their overall tax burden. Furthermore, two assumptions are introduced: tax avoidance is available exclusively to MNEs due to their international presence, and all firms are profit maximising. From these two assumptions it should follow that MNEs enjoy a competitive advantage over domestic firms. While the first are able to lower their tax burden through tax avoidance strategies, the latter have to adhere to the tax regime in their country of residence. This competitive advantage may negatively affect the performance of domestic firms, who effectively face a higher cost of capital compared to the MNEs they compete with, holding all else equal.

2.3. *Empirical and anecdotal evidence of tax avoidance*

The previous section provided an overview of the tools used by MNEs to minimise their tax burden, and explained how these tools yield a tax induced competitive advantage over

domestic firms. The aim of this section is to provide the notion that tax avoidance is a widespread practise among MNEs with empirical support. To this end, this section will summarise both empirical and anecdotal evidence from the literature on tax avoidance. Before presenting the literature on this topic, it is important to stress the difficulty of estimating the prevalence of the use of tax avoidance strategies among firms. As illustrated in the introduction of this study, firms are not transparent in the disclosure of their tax strategies. Tax avoidance schemes are only revealed sporadically, through intensive investigation or whistleblowing. Even though tax avoidance is not illegal in principle, large scale tax avoidance does not make companies popular among the general public. Furthermore, the tax constructions may sometimes border on illegality, for instance when they violate the European Union's state aid rules. In sum, although the sporadic revelations of existing tax avoidance schemes are suggestive of a widespread use of them, evidence remains largely anecdotal. However, this does not mean that it is impossible to test for the existence of tax avoidance empirically.

A large number of empirical studies find that within MNEs, reported profits vary systematically with local corporate tax rates (Davies et al., 2014). These studies support the notion that tax avoidance is common practise among MNEs, but they provide no conclusive evidence. A study that provides a more accurate measure on tax avoidance is conducted by Davies et al. (2014). These authors use a detailed dataset from a set of French firms in 1999, containing both transfer prices and arm's length prices for the manufacturing industry, to detect transfer price manipulation practises. The study provided evidence for the manipulation of transfer prices by MNEs for tax avoidance purposes, in which tax havens played an important role. However, the authors also found that the use of transfer price manipulation is mainly reserved for large MNEs. It is important to stress here that datasets like the one used by Davies et al. (2014) are unique in their level of detail. Also, the dataset here is limited in scope, including French firms from one sector in one particular year.

An analysis of the literature on the other main tool used for tax avoidance purposes, internal debt structures, yields similar insights. Numerous papers show that the capital structure of MNEs' affiliates is sensitive to the tax rate in the affiliates' host country (Buettner and Wamser, 2013). Also, there is empirical evidence to support that interest payments from foreign affiliates respond to taxes (Collins and Shackelford, 1998). But, although empirical literature supports the notion that an MNEs internal debt structure is sensitive to taxes, it is again difficult to draw definitive conclusions on whether and to what extent internal debt structures are actually used for tax avoidance purposes. Buettner and Wamser (2013) aim to provide some estimation of the extent to which internal debt is used by MNEs for tax avoidance purposes. To this end, these authors use a micro level panel database containing virtually all German MNEs. The empirical results support the notion that internal debt is

used to shift taxable profits to low tax countries. However, the results also indicate that the magnitude of tax effects is rather small, implying that internal debt is a rather unimportant tax avoidance tool for German firms. The empirical studies of the use of transfer pricing and debt structures introduced above portray a similar picture: the notion that tax avoidance seems widespread but is difficult to test. Empirical tests that accurately estimate tax avoidance rely on detailed datasets, which are rare and tend to be narrow in scope, meaning that caution is in order in generalising the results of such tests. In addition to the empirical studies summarised above, several leaks and investigations have provided insights regarding the use of tax avoidance strategies by MNEs. These events and the conclusions that can be drawn from them will be discussed below.

The 'Luxembourg leaks' introduced in section 1 provide a more detailed insight into the tax avoidance practises MNEs engage in. Marian (2017) analyses the information revealed from the leaks and describes a form of tax competition where national governments actively assist MNEs in lowering their tax burden. In fact, this study identifies "*intentional "beggar thy neighbor behavior", aimed at attracting revenue generated by successful investments in other jurisdictions, without attracting actual investments.*" (Marian, 2017, p. 1). This suggests that governments engaging in this form of tax competition do not merely set a low tax rate in order to attract investments, but offer MNEs assistance in shifting their profits to reduce taxable profits. The behaviour described by Marian involves a separation of profits from investments, thereby contrasting the theory of tax competition described in section 2.1, which describes that governments set their tax rate such that the tax income offsets the provision of public goods. Instead, the countries providing the infrastructure (public goods) and workforce to support economic activity, are not awarded its revenues in the form of tax income. This development in tax competition, and the way it affects governments, is not directly relevant to the aim of this paper however. The focus on the competition effects of tax competition on the firm level does not include an assessment of the effect on governments. However, the findings from Marian (2017) are relevant in the sense that they describe how national governments are actively involved in the tax avoidance practises of MNEs, which is indicative of how widespread such practises are. Evidently, the 'Luxembourg leaks' refer to Luxembourg's government only. However, investigations by the European Commission into Ireland and the Netherlands show that Luxembourg is not the only culprit. But again, one should keep in mind that leaks such as those in Luxembourg only show the tip of the iceberg. They provide important insights but give no indication as to how widespread the issue is.

Finally, in addition to literature on the extent of tax competition it is important to consider studies on the effect of this phenomenon on competition between MNEs and domestic firms. However, literature on this relation seems to be nonexistent. This lack of

research is no surprise, considering the difficulty of studying tax competition and tax avoidance in general. This means however, that this study can be regarded as an introductory research into the effects of international tax competition and tax avoidance on the competition between MNEs and domestic firms.

To summarise, sections 2.1 through 2.3 provided a concise overview of the theory and empirical literature on tax avoidance. The consensus seems to be that tax avoidance is common practise among MNEs, although the nontransparent nature of tax avoidance makes it difficult to support this notion with any conclusive evidence. However, based on the literature presented in section 2.3, the assumptions introduced in section 2.2 will be maintained. For the remainder of this study, it will therefore be assumed that all MNEs are able to use their international position to shift profits globally, thereby lowering their tax burden. Domestic firms on the other hand have no access to such tax avoidance practises, giving MNEs a competitive advantage over domestic firms. From the assumption that all firms are profit maximising it follows that this competitive advantage culminates into improved MNE performance relative to domestic firms, holding all else equal. Competition between MNEs and domestic firms thus should favour the first, imposing a negative effect on the latter.

3. Data

This section discusses the data that are used in the empirical part of this study in section 5. Section 3 is divided into four subsections, which describe the characteristics and quality of the dataset. Section 3.1 describes the overall dataset in terms of the variables, geographical scope and the time period it covers. The overall quality of the data is discussed in sections 3.2 through 3.4, which focus on the validity, representativity and reliability of the sample respectively.

3.1. The dataset

As explained in section 2.2 and 2.3, tax competition and tax avoidance affect firms by distorting competition. This distortion arises as MNEs enjoy a tax induced competitive advantage over domestic firms. When these two types of firms compete, this competitive advantage should positively affect the performance of MNEs and negatively affect the performance of domestic firms. In order to identify and quantify this negative relation, the data used in this study should measure the performance of MNEs and domestic firms separately. In this research, the performance of MNEs and domestic firms is therefore captured by using two proxy variables: gross turnover and the number of active firms. Both variables are measured annually and are denoted in terms of industry aggregates.

Furthermore, in order to be able to detect any relation between the performance of MNEs and domestic firms the variables are measured separately for each of the two firm types.

The two proxy variables are included in a panel dataset that covers the manufacturing industry in 21 European OECD countries over the period 2008-2014. The observations that comprise this dataset are drawn from the OECD database. The OECD database contains no data from before 2008 for the variables used in this study. Therefore, the selected time period, 2008-2014, is dictated by the availability of data. Within the OECD database two datasets are consulted, which will now be discussed in turn. The first dataset is the *inward activity of multinationals by industrial sector – ISIC Rev. 4*, which will be referred to as the 'MNE dataset' for the remainder of this study. The MNE dataset contains all observations that relate to the performance of MNEs in each of the 21 countries included in the sample. The second dataset is the *structural business statistics – ISIC Rev. 4*, which will be referred to as the 'business statistics dataset' for the remainder of this paper. The business statistics dataset contains all observations that relate to the performance of domestic firms in each of the 21 countries included in the sample.

In sum, this study uses a panel dataset which contains two proxy variables that capture firm performance: gross turnover and the number of active firms. These indicators are measured separately for MNEs and domestic firms, in order to allow for the identification of a negative relation between these two types of firms. The dataset covers the manufacturing industry in 21 European OECD countries over a time period of seven years.

3.2. *Validity*

The aim of this study is to measure the effect of international tax competition on the competition between MNEs and domestic firms. Evidently, industry turnover and the number of firms are no direct estimate of this relation. In fact, these variables are approximations that merely capture firm performance at the sector level. Sector level firm performance is affected by a variety of different factors, most of which cannot be attributed to international tax competition. For example, changes in demand for the industry's output or regulations imposed by a government are not directly related to international tax competition, but may affect the performance of both MNEs and domestic firms nonetheless. The use of turnover and the number of active firms as approximations of firm performance thus affects the validity of the data, as they do not fully capture the relation under study.

A more accurate estimation of the effect of an MNE's tax induced competitive advantage would require a measure of the additional loss or benefit at the firm level that can be attributed to international tax competition. However, as illustrated in section 2.3 such a measure requires detailed firm level data that is generally only available to the tax avoiding firm itself. Recall from section 2.3 that studies on tax avoidance and tax competition in

general suffer from a lack of accurate data due to the nontransparent nature of tax avoidance. In light of this data availability issue, the use of turnover and the number of firms as proxy variables in this study can be justified by the fact that more detailed measurements of (the effects of) tax competition are not available.

A more serious issue regarding the validity of the sample is presented by the composition of the OECD datasets. Recall that data from the MNE dataset are used to estimate the performance of MNEs, and that data from business statistics dataset are used to estimate the performance of domestic firms. But where the MNE dataset relates exclusively to MNEs, the business statistics dataset represents the performance of all firms registered in a country, including MNE subsidiaries. The business statistics dataset does not distinguish between foreign or domestic firm ownership. Instead, firms are classified based on their size in terms of the number of employees. More specifically, enterprises are classified as either SMEs or large enterprises (LEs). SMEs are all firms with 1 to 249 employees, and LEs are all firms with 250 employees or more. The problem of the classification system used in the business statistics dataset is illustrated in figure 1, which shows how firms are classified differently in the MNE and the business statistics dataset. The MNE dataset classifies firms based on ownership, which is shown along the figure's vertical axis. The business statistics dataset on the other hand classifies firms in terms of size, shown along the figure's horizontal axis. All firms included in the MNE dataset fall within either the bottom left or bottom right cell of figure 1, although the dataset does not distinguish between the two. The business statistics dataset on the other hand includes all firm that fall within any of the four cells. However, this dataset only distinguish between the left and right column. Because the business statistics dataset classifies firms based on size rather than ownership, domestic firms cannot be separated from MNEs. This in turn means that data from the business statistics dataset are not an exact representation of the performance of domestic firms, as they also include foreign owned companies (i.e. MNE subsidiaries).

		Firm size (employees)	
		1-249	**250+**
Ownership	**Domestic**	SME	LE
	International	MNE	MNE

Figure 1 Overview of different types of enterprises in terms of size and ownership. Three firm types are included: Small and Medium sized Enterprises (SMEs), Multinational Enterprises (MNEs) and Large Enterprises (LEs).

There is no way to solve this validity issue completely but its impact can be minimised by taking only SMEs, rather than both SMEs and LEs, as a proxy for domestic firms. The reasoning behind excluding the LEs from the domestic firm sample is that the share of MNEs is most likely larger among firms in this size group, compared to SMEs. This reasoning can be supported by referring to a size distribution provided in table 1 in the appendix. This

distribution shows the number of SMEs, LEs and MNEs as a percentage share of the total number of firms, for each of the countries in the dataset. Across most countries, SMEs represent between 97 and 99 percent of the total number of firms in the manufacturing industry. LEs on the other hand are responsible for roughly one percent of all firms in most countries. From this follows that any MNEs labelled as an SME in the business statistics dataset only comprise a small portion of the total number of firms in this size group. The number of MNEs in the LE size group on the other hand will most likely be larger in relative terms. In other words, the inclusion of MNE subsidiaries in the business statistics dataset is likely to be more distortionary within the LE size group. Additionally, one could argue that MNE subsidiaries are more likely to be large in size since they are part of a large international organisation, and are therefore more likely to be labelled as an LE. However, this reasoning cannot be verified using the sample.

Another way in which this validity issue is addressed, is by including two proxy variables in the dataset rather than one. A second proxy variable, the number of active firms, is included because it is less sensitive to the presence of MNEs in the domestic firm data. The reasoning behind including this variable, and how it is used to account for the validity issue, is explained in detail in section 4.2. But in short, the added value of using the number of firms lies in the fact that this measure is dichotomous at the firm level. A firm either exists (1) or does not exist (0). The implication of this is that a small number of MNEs included in the domestic firm data has only a limited effect on the overall sample, increasing the number of firms measured within an industry. The same reasoning does not hold for turnover, the value of which can vary widely at the firm level. This means that a small number of MNEs can have a large impact on the domestic firm sample if the turnover of these firms is structurally higher than the turnover of domestic firms. As a result, the observed industry level turnover can differ substantially from the actual (unobserved) industry level turnover of domestic firms, depending on whether there is a large and structural gap between the turnover of MNEs and domestic firms.

In sum, the sample is subject to some validity issues. The most prominent issue is the lack of a distinction between foreign and domestic ownership in the business statistics dataset, which means that the data drawn from this set are no exact representation of domestic firm performance. This issue is addressed by limiting the data representing domestic firm performance to SMEs, and by including the number of firms as an approximation of firm performance.

3.3. Representativity

As explained in section 3.1, the observations in the panel dataset are measured at the industry rather than the country level. In fact, the data are compiled only for one industry:

manufacturing. The performance of both MNEs and domestic firms is measured at the industry level in order to account for industry specific characteristics. Besides controlling for industry specific characteristics, narrowing the scope of the research to one industry allows for a more in depth analysis. The selection of the manufacturing industry rather than any other industry is based on the context of this study. Given the international nature of the phenomenon of tax competition, the industry that is studied should also be characterised by a strong global presence. The reasoning behind this is that a highly international industry should be affected more strongly by international tax competition, making it more likely that this study detects any effects of this phenomenon on competition. The manufacturing industry derives its international presence for an important part from the high tradability of its output, as will be explained below.

Manufacturing output is particularly tradable since it is characterised by goods rather than services. Contrary to goods, services tend to require face to face interaction which makes them more difficult to trade internationally (Bradford Jensen, 2011). To illustrate the difference between goods and services, consider a simplified example with two products: a haircut and a car. A haircut is a service and is therefore nearly impossible to import or export cost effectively, as it cannot be separated from the seller offering the service. This is not the case for a car, which is a typical manufacturing good. A car or its components can be transported across the globe with relative ease, as they require little physical interaction between the buyer and the seller. The tradability of goods has created a large international market for final and intermediate manufacturing products. This international market has allowed for the rise of global value chains that connect firms across the world and give the manufacturing industry its international character.[3]

In the context of this study, the international orientation of the manufacturing industry means that domestic firms in this industry should be more exposed to the international markets, which means they are more likely to interact or compete with MNEs. The supposedly greater interaction between MNEs and domestic firms in manufacturing makes this industry particularly suitable to study the effect of international tax competition on the competition between these two types of firms. However, one should also keep in mind that the industry specific characteristics that dictated the focus on the manufacturing industry also mean that caution is required in extrapolating any results to the entire population (i.e. firms in general).

As mentioned in section 3.1, the geographical scope of the data is limited to European OECD member countries. Also, all countries in the sample are a member of the European Union, with the exception of Norway. As a result, the sample used in this study contains

[3] The scope of this study does not allow for an extensive analysis of the internationalisation of manufacturing production and the rise of global value chains. However, a comprehensive analysis of this subject is provided by Baldwin et al. (2012).

predominantly high income countries from one integrated economic region. It is important to note that the selection of this relatively homogeneous group of countries implies that any results may not accurately represent the reality in lower income regions such as Africa, Asia or even the European periphery countries.

To summarise, the representativity of this study is limited to the manufacturing industry for three reasons: to account for industry specific characteristics, to allow for a more in depth analysis and because the manufacturing industry fits well within the international context of this research. Also, the geographical scope is limited to Europe and covers predominantly high income countries. The focus on one industry and mostly high income countries by no means implies that any results cannot be extrapolated to other regions or industries, but some degree of caution is warranted in interpreting these results.

3.4. Reliability

Recall from section 3.1 that both the MNE and domestic firm data are drawn from the OECD database. The observations are collected through a combination of business surveys, economic censuses and business registers. However, these observations are not directly generated by the OECD, but are collected from national banks and central statistics offices in the countries that are included in the dataset. This means that the overall reliability of the data depends on the quality of the national sources that provided the input. The OECD does not provide information on how its datasets are constructed exactly; individual observations are not traceable to a particular statistics office or other institute. The use of different sources presents a potential reliability issue if these sources adopt varying methods or standards regarding the collection of their data. The reliability of the data may thus vary across countries.

Another reliability issue concerns the consistency of the sample over time and across countries. Although the data series were largely complete for the years 2008-2014, several country-year observations are either missing or incomplete.[4] Missing observations are an important factor in a panel dataset, where a dependent variable y in year t corresponds to an independent variable x in the same year. Without a corresponding x observation, an observation y is of no use, and vice versa. Before any empirical analysis can be applied to the data, missing or incomplete country-year observations therefore need to be either omitted from the sample or replaced with an appropriate estimation. Missing observations thus present a dilemma regarding the reliability of the sample. On the one hand, omitting missing or incomplete country-year observations rather than replacing them with estimations ensures that the remaining data are accurate. Estimations may deviate strongly from the actual

[4] Within the context of this study, a country-year observation refers to all variable values corresponding to the combination of one particular year and one particular country.

(unobserved) values, affecting the reliability of the sample. On the other hand, omitting too many values reduces the total number of observations, limiting the usefulness of the dataset.

In order to address this dilemma, a combination of replacement and omission is used. Large gaps in observations, that is incomplete or missing country-year observations for two or more subsequent years, are omitted altogether. However, if data is missing or incomplete for only one country-year observation, missing observations are replaced with estimates. In order to understand how missing observations are replaced, consider figure 2, which shows a stylised version of a panel dataset. In this figure, observations are missing for country *B* in 2008 and 2011, but they can be replaced. Replacement occurs in two ways: by copying the value of the same variable from the adjacent year, or by taking the average value of the variables in two adjacent years. This means that the missing data for country *B* in 2008 are replaced with 2009 values, such that variables *f* and *g* take the values three and four respectively. The missing 2011 observations are replaced with an average of the 2010 and 2012 observations of the corresponding variables, such that the variables *f* and *g* take the value of six and seven respectively. The rationale behind using values of adjacent years to replace missing observations is that the adjacent observations are most likely to closely approach the true value of the missing observations. This minimises the negative effect of estimating the value of missing observations. Initially, the turnover and firm number data were collected for 23 European OECD countries.[5] Following the steps outlined above several country-year observations were replaced or omitted, and one country (Greece) was removed from the sample completely.

country	**year**	**variable f**	**variable g**
A	2014	1	2
B	2008	*missing value*	*missing value*
B	2009	3	4
B	2010	5	6
B	2011	*missing value*	*missing value*
B	2012	7	8

Figure 2 A simplified representation of a part of a panel dataset with several missing observations.

As a final step, Luxembourg was excluded from the sample. Luxembourg was excluded not due to a lack of observations, but because it is a clear outlier. This mini state stands out because of the dense concentration of MNEs located within its borders. Table 1 in the appendix shows that MNEs in Luxembourg number at around 33 percent of the total number of firms. This figure is in sharp contrast with the rest of the sample, where this percentage lies below seven percent.

5 A list of these countries can be found in the appendix.

In sum, no considerable reliability issues are identified, but it is important to be aware of the fact that the OECD datasets are composed of observations from various national sources. Furthermore, several incomplete country-year observations were omitted or replaced with estimations. Ultimately, the OECD datasets have yielded a panel dataset containing 143 country-year observations and 21 countries.

4. Model

This section introduces and explains the methodology that is used to identify empirically the existence of a structural and tax induced competitive advantage that MNEs hold over domestic firms. The methodology used in this study is a simple linear regression that captures the relation between the performance of MNEs and domestic firms. This relation is described in two separate logarithmic models, which are described in sections 4.1 and 4.2. Combined, these two models should provide a rather comprehensive assessment of the relation between the performance of MNEs and domestic firms in the context of international tax competition.

4.1. Model one

The first model captures the relation between MNE and domestic firm performance in terms of industry level turnover. This model is described in equation 1 and regresses the annual change in the domestic firm turnover on the annual change in MNE turnover. All variables are denoted in terms of annual change in order to control for a potential time trend. To allow for the logarithmic transformation of annual change values, the sample cannot contain any negative values. Variables are therefore denoted as a factor of change rather than a measure of incremental change.[6]

(1) $$\log(\Delta DOMturn_{t,i}) = \beta_0 + \beta_1 \log(\Delta MNEturn_{t,i}) + \beta_2 \log(\Delta DOMnr_{t,i}) + \beta_3 \log(\Delta MNEnr_{t,i}) + \beta_4 \log(\Delta MAN_{t,i}) + \beta_5 \log(\Delta CPI_{t,i}) + \beta_6 \log(\Delta IM_{t,i}) + \beta_7 \log(\Delta GDP_{t,i}) + \varepsilon_{t,i}$$

In equation 1, dependent variable $\Delta DOMturn_{t,i}$ denotes the change in turnover of domestic firms in the manufacturing industry in year *t* and country *i*. Similarly, independent variable $\Delta MNEturn_{t,i}$ measures the annual change in turnover of MNEs in a country's manufacturing industry. The annual change in the number of domestic firms and MNEs, denoted by $\Delta DOMnr_{t,i}$ and $\Delta MNEnr_{t,i}$ respectively, are included as control variables in this model. These variables should capture any changes in firm turnover that result from the entrance or exit of firms rather than changes in the average turnover (i.e. firm level turnover)

[6] It is impossible to take a logarithm of a negative value. The data used for equation 1 are therefore transformed into a factor of change by adding one to each observation. For example, an annual change of -3% is denoted as 0.97 after transformation.

within the industry. The other control variables that are included are the gross production of the manufacturing industry ($\Delta MAN_{t,i}$), consumer price index ($\Delta CPI_{t,i}$), total goods imports ($\Delta IM_{t,i}$), and GDP ($\Delta GDP_{t,i}$). The aim of these variables is to capture exogenous factors that affect both the dependent and the independent variable. To this end, manufacturing production and goods imports are included as approximations of the performance of the entire manufacturing industry. Similarly, consumer price index and GDP are included to account for the performance of a country's economy in general.

Finally, it is important to stress that because the variables in equation 1 are measured in terms of annual change, the number of observations in the sample has been reduced from 143 to 122. Because OECD data on the dependent and independent variable is not available before 2008, the annual change in 2008 (relative to 2007) cannot be determined. The year 2008 is therefore omitted from the sample that is used for model one, which now covers only the years 2009-2014.

4.2. *Model two*

Model one outlined above measures firm performance in terms of turnover. However, recall from section 3.2 that the sample contains a measurement issue because the business statistics dataset does not distinguish between domestic and foreign firm ownership. As a result the domestic firms in the sample may also include MNE subsidiaries. In order to account for this a second model is included, which uses changes in firm numbers rather than turnover to estimate the relation between MNE and domestic firm performance. This model is described in equation 2. Measuring performance in terms of firm numbers rather than turnover should limit the impact of the included MNEs on the domestic firm sample. The reasoning behind this is that MNE turnover should be structurally higher than domestic firm turnover, following the theoretical predictions outlined in section 2. The inclusion of MNE subsidiaries in the domestic firm sample may thus inflate the average turnover of this sample, which means that it does not accurately represent the population. Because the sample does not contain firm level data, whether and to which extent MNE turnover differs from domestic firm turnover in the SME size class cannot be determined. The ratio of MNEs to domestic firms in the SME size group can be determined however, or at least estimated. Recall from the firm size distribution in table 1 in the appendix that the share of MNEs as a percentage of all manufacturing firms lies below four percent in most countries in the sample. This four percent includes MNEs in both the large (LE) and small (SME) size groups. Furthermore, all LEs are omitted from the sample. From this follows that the share of SME sized MNEs in country *i*'s manufacturing industry must lie below four percent. Furthermore, the number of firms is dichotomous at the firm level in the sense that a firm either exists (1) or does not (0). All firms are therefore allocated an equal weight in determining the aggregate

number of firms in the manufacturing industry. This means that included MNEs do not inflate any average in the domestic firm sample. In contrast, turnover can take any value at the firm level, which means that aggregate industry turnover is affected strongly by firms with high turnover values but little by firms with low turnover values.

In sum, this study uses two approximations to estimate the relation between MNE and domestic firm performance. Model two uses firm numbers as dependent and independent variable in order to reduce the impact of the measurement issue raised in section 3.2 and explained above. The inclusion of an alternative dependent and independent variable does not eliminate this issue completely, but model two limits the impact of this issue for two reasons: the severity of the measurement issue can be estimated using a firm size distribution, and included MNEs do not affect the sample other than increasing the total number of firms.

(2) $$\log\left(\Delta DOMnr_{t,i}\right) = \beta_0 + \beta_1 \log\left(\Delta MNEnr_{t-2,i}\right) + \beta_2 \log\left(\Delta MAN_{t,i}\right) + \beta_3 \log\left(\Delta CPI_{t,i}\right) + \beta_4 \log\left(\Delta IM_{t,i}\right) + \beta_5 \log\left(\Delta GDP_{t,i}\right) + \varepsilon_{t,i}$$

In equation 2, dependent variable $\Delta DOMnr_{t,i}$ denotes the annual change in the number of domestic firms in country i and year t. Independent variable $\Delta MNEnr_{t-2,i}$ denotes the annual change in the number of MNEs for country i with a two year lag. This lag is included to account for the fact that any change in the performance of MNEs within the country will most likely not have an immediate effect on the number of domestic firms. If increased competition and the MNEs competitive advantage indeed cause domestic firms to exit the market, they will most likely do so after some years of competition with the new entrants. The four control variables that are included are identical to those in equation 1. And like the first model, the variables depicted in equation 2 are measured in terms of factors of change rather than incremental changes.

Finally, it is important to point out that the inclusion of a lagged independent variable in model two has further reduced the number of country-year observations from 122 to 80. The inclusion of a lagged independent variable means that a dependent variable value from year t corresponds with an independent variable from year t-2. This means that the dependent variable values in equation 2 have no corresponding independent variable for the years 2009 and 2010, as this would require observations of the annual change in 2007 and 2008 respectively. As explained in section 4.1 the scope of the dataset is limited to 2008, which means that these observations are not available. In sum, dataset used for model two thus covers 80 country-year observations for the years 2011-2014.

5. Results

This section presents the empirical results related to the two models introduced in section 4.1 and 4.2. The section can be divided into four subsections. In sections 5.1 and 5.2, the main outcomes of a series of regressions related to model one and model two from section 4 are discussed in turn. In section 5.3, the reliability of the data is assessed by summarising and examining the results of several stability tests. More specifically, section 5.3 includes the results of stationarity, normality and heteroscedasticity tests. Finally, section 5.4 concludes with a short summary of the main empirical findings and relates these findings to the literature.

5.1. Testing model one

As a first step towards providing the theory of section 2 with an empirical foundation model one was tested using eleven regressions, the results of which are depicted in table 1. In order to account for intra-country differences, all regressions use fixed effects. Furthermore, any exogenous factors that may affect both MNE and domestic firm turnover are accounted for by the inclusion of a variety of control variables. Most of these variables are explained in section 4.1, but the regressions also include a measure of private consumption expenditure (*CONS*), goods exports (*EX*), average hourly earnings in the manufacturing industry (*EARN*), and a score on the Global Competitiveness Index (*GCI*). The aim of these variables is to capture the country and industry level economic environment. Consumption captures part of the general economic environment within a country, the Global Competitiveness Index provides a measure of a country's overall competitive climate, and goods exports and manufacturing earnings are approximations of the state of the manufacturing industry.[7] Like the control variables introduced in section 4.1, these variables are measured as an annual factor of change at the country level. The data for these variables is drawn from the OECD database and the Global Competitiveness Index. In sum, the regressions in table 1 contain an independent variable (*MNEturn*) and ten control variables. However, be aware that several control variables capture the same exogenous factors: the general and industry level economic environment that affects the performance of MNEs and domestic firms alike. In columns two to eleven in table 1, variables are therefore eliminated stepwise in order to identify a regression that accurately captures the relation described by the model using a limited number of variables.

Before moving on to a description of the regression results, it is important to stress that all coefficient values depicted in table 1 are logarithmic transformations. Coefficient values should therefore be interpreted as elasticities rather than slopes. In other words,

[7] Although the measure of goods exports does not relate exclusively to the manufacturing industry, it is considered a proxy based on the notion that the manufacturing industry is both large and characterised by the production of goods rather than services.

coefficient values denote the percentage change in the dependent variable, caused by a one percentage change in the independent variable.

Overall, the regressions in table 1 seem to capture the relation between MNE and domestic firm performance reasonably well, judging from the R^2 values. The regressions explain around 77 percent of the log change in domestic firm turnover. One exception is column eleven, which displays an R^2 value that is considerably lower at 51 percent.

Column one shows a negative and statistically significant effect of MNE turnover on domestic firm turnover at the ten percent level. Additionally, the control variable coefficients for manufacturing production, the number of domestic firms and the consumer price index are positive and statistically significant. The manufacturing production and consumer price index coefficients are particularly large at 0.845 and 0.941 respectively, which indicates that these variables have an almost one to one relation with the dependent variable.

The size and significance of the variables in columns two to four show little variation compared to column one, indicating that the dropped variables are of little statistical relevance to the relation between the dependent and independent variable. While the independent variable coefficient changes little, its t value becomes more negative (i.e. more significant) as more control variables are omitted.

Column five contains only the variables that are included in model one as it is explained in section 4.1. The independent variable remains largely unchanged at -0.148 but is now statistically significant at the five rather than the ten percent level. In addition to the coefficient for manufacturing production, consumer price index and number of domestic firms, the goods imports coefficient is now significant at the ten percent level. Furthermore, the sign of the GDP coefficient changed from negative to positive as the private consumption control variable was dropped. However, the GDP coefficient's t value remains too low to indicate any significant deviation from zero. Overall, the variables included in column five have changed little compared to columns one through four. Combined with the fact that it contains fewer control variables, the regression in column five captures the relation between MNE and SME turnover more efficiently than previous regressions.

In columns six to ten, both the size and significance of the independent variable coefficient decrease as more control variables are omitted. And in columns eight to ten, the p values exceed the ten percent threshold. The decreasing significance of the t values suggest that the control variables dropped in columns six to ten are important in capturing exogenous factors that affect both the turnover of MNEs and SMEs.

Finally, column eleven deviates from preceding columns by showing a positive and strongly significant effect of MNE turnover on SME turnover. The independent variable coefficient is not only positive, but also considerably higher than its counterparts in columns

one through ten. Also, note that the R^2 value is 20 to 25 percent lower compared to previous regressions.

Table 1 Regression results of model one. ***, ** and * indicate significance on the 1%, 5% and 10% level respectively. The determination of significance is based on one sided t tests.

Variables (log)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dependent variable: ΔDOMturn						
Constant	-0.004	-0.002	-0.002	-0.002	0.001	0.002
	(-0.33)	*(-0.18)*	*(-0.25)*	*(-0.30)*	*(0.09)*	*(0.24)*
ΔMNEturn	-0.146	-0.147	-0.147	-0.148	-0.148	-0.124
	*(-1.94)**	*(-1.97)**	*(-1.99)***	*(-2.04)***	*(-2.03)***	*(-1.74)**
ΔMAN	0.845	0.849	0.849	0.847	0.800	0.745
	*(5.21)****	*(5.27)****	*(5.33)****	*(5.38)****	*(5.15)****	*(4.96)****
ΔIM	0.130	0.130	0.130	0.116	0.113	0.119
	(0.91)	*(0.91)*	*(0.94)*	*(1.77)**	*(1.72)**	*(1.80)**
ΔDOMnr	0.102	0.103	0.103	0.103	0.096	0.098
	*(4.16)****	*(4.19)****	*(4.23)****	*(4.28)****	*(4.05)****	*(4.09)****
ΔCPI	0.941	0.896	0.896	0.902	0.700	0.644
	*(2.24)***	*(2.21)***	*(2.26)***	*(2.31)***	*(1.90)**	*(1.75)**
ΔGDP	-0.153	-0.162	-0.163	-0.159	0.275	0.356
	(-0.36)	*(-0.39)*	*(-0.41)*	*(-0.40)*	*(1.00)*	*(1.32)*
ΔMNEnr	0.102	0.104	0.104	0.105	0.101	
	(1.30)	*(1.34)*	*(1.35)*	*(1.36)*	*(1.31)*	
ΔCONS	0.452	0.428	0.428	0.440		
	(1.38)	*(1.33)*	*(1.37)*	*(1.50)*		
ΔEX	-0.017	-0.016	-0.016			
	(-0.12)	*(-0.11)*	*(-0.12)*			
ΔEARN	0.033	-0.001				
	(0.09)	*(-0.00)*				
ΔGCI	-0.205					
	(-0.42)					
Fixed effects	yes	yes	yes	yes	yes	yes
R^2	0.774	0.775	0.775	0.775	0.767	0.761

Variables (log)	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
Dependent variable: ΔDOMturn					
Constant	0.003	0.013	0.014	0.013	-0.007
	(0.42)	*(2.63)***	*(2.62)***	*(2.40)***	*(-1.05)*
ΔMNEturn	-0.123	-0.097	-0.068	-0.034	0.576
	*(-1.72)**	*(-1.38)*	*(-0.91)*	*(-0.45)*	*(10.52)****
ΔMAN	0.826	0.770	0.761	1.016	
	*(6.00)****	*(5.72)****	*(5.27)****	*(9.51)****	
ΔIM	0.142	0.169	0.170		
	*(2,23)***	*(2.72)****	*(2.54)***		
ΔDOMnr	0.100	0.094			
	*(4.18)****	*(3.94)****			
ΔCPI	0.610				
	(1.66)				
ΔGDP					
ΔMNEnr					
ΔCONS					
ΔEX					
ΔEARN					
ΔGCI					
Fixed effects	yes	yes	yes	yes	yes
R^2	0.760	0.752	0.722	0.701	0.513

Combined, the regressions shown in columns one to eleven provide a rather complete picture of the relation between MNE and domestic firm turnover. Not all control variables were equally effective in isolating the relation between the dependent and independent variable, but manufacturing wages, goods imports, the number of domestic firms, consumer price index and the GDP seemed to capture the industry and country level economic environment rather well. The control variable with the largest impact on the independent variable is manufacturing production, as suggested by the fact that the *MNEturn* coefficient changes sign and becomes strongly significant when this control variable is dropped lastly in column eleven. More importantly, the results in column eleven demonstrate the importance

of including control variables to isolate the effect of MNE performance from other, exogenous factors. The regressions in columns one through seven are all in line with the theoretical predictions, albeit to various extents. The regression that captures the effect of MNE performance on domestic firm performance most effectively however can be found in column five.

5.2. Testing model two

Model two is tested using a series of regressions that is similar to those displayed in table 1. These regressions use the same variables, with the addition of a one and two year lagged independent variable to account for any delay in the relation between the entrance of MNEs and the exit of domestic firms from the market. This brings the number of included right hand variables to thirteen. Overall, the regression results are not particularly conclusive, therefore they are included in table 2 in the appendix rather than this section. Nevertheless, several main findings will be discussed concisely below.

Although model two explains the same relation as model one, low R^2 values suggest that it is considerably less accurate in capturing this relation. More specifically the regressions explain between 0.5 and 36 percent of the log change in the number of domestic firms, where the 0.5 percent R^2 value corresponds to the last regression, which only includes the dependent and independent variable. Combined, the pattern of R^2 values across the regressions suggest that the majority of the change in the number of domestic firms is explained through the control variables rather than the independent variable. By extension, this suggests that the number of MNEs and domestic firms are a particularly poor approximation of the relation under study. Furthermore, none of the regressions find a statistically significant relation between the number of MNEs and the number of domestic firms. Only three variables are consistently significant: domestic firm turnover, manufacturing production and the consumer price index. Given the strong relation between the number and turnover of domestic firms depicted in table 1, the significant *DOMturn* coefficient in model two is no surprise. What is more surprising is that both the *MAN* and *CPI* coefficients have a negative sign throughout all regressions, suggesting a negative relation with the dependent variable. This contrasts with their coefficient values in table 1. Overall however, the control variables failed to isolate the relation between MNE and domestic firm performance, while the independent variable alone seems to be a particularly poor estimator of the relation under study.

5.3. Stability testing

Before any conclusions can be derived from the findings summarised above, an assessment of the reliability of the data is in order. To this end, three stability tests are conducted. First,

each variable included in table 1 above and table 2 in the appendix is tested for the existence of stationarity using an inverse chi squared test with the null hypothesis that all panels (countries) in the dataset contain unit roots and the alternative hypothesis that at least one of the panels is stationary. The second and third stability test consider the normality and homoscedasticity of the regressions' residuals. To test the assumption of normality, the quantiles of the regression residuals are plotted against the quantiles of the normal distribution. To detect heteroscedasticity, the distribution of the residuals is displayed in a residuals versus predictor plot. The results of these stability tests are summarised in tables 3-4 and figures 1-2 in the appendix, and will be discussed in more detail below.

Let us first consider the stability of the dataset used for model one. The inverse chi squared p statistics soundly reject the null hypothesis that all panels contain a unit root for each of the variables, suggesting that all variables are stationary. As for the assumption of normality, the residuals closely follow the diagonal line in the quantiles plots bar from a few outliers. This pattern is rather similar throughout all regression and suggests that the errors largely follow a normal distribution in each regression. The residuals versus predictor plots show that the residuals show little sign of heteroscedasticity. The values are rather symmetrically distributed and concentrated around zero in the centre of the plot. The plots do not follow a particular trend, apart from a slight bias towards the bottom left of the graph.

For model two only the normality and heteroscedasticity tests are of relevance. Testing for nonstationarity is not necessary for model two, as the sample covers only a limited number of years. Recall from section 4.2 that the number of observations in the sample corresponding to model two is reduced due to the inclusion of a one and two year lagged variable. This reduces the number of years t in the dataset from six to four. Additionally, several country-year observations were already omitted earlier due to incomplete data, as explained in section 3.4. The irrelevance of testing for nonstationarity in a sample that covers a short time period is confirmed by running the unit root tests on the model two sample. The outcomes of these tests are included in table 4 in the appendix and show no meaningful results, depicting inverse chi squared statistics of 0.000 for all variables.

Next, the normality and heteroscedasticity tests are conducted. First, the quantiles plots show that the residuals of the regressions from model two follow the diagonal line less closely, indicating non-normality in the distribution of these errors. Second, the residual versus predictor plots show the regression residuals to be strongly heteroscedastic, with the values following a clear trend throughout all plots. The non-normality and heteroscedasticity in the regressions' errors implies that a certain degree of caution is required in the interpretation of the regression results of model two.

In sum, the data used for model one seem to be rather stable. The tests show no sign of nonstationarity, non-normality or a high degree of heteroscedasticity. The same cannot be

said for data used for model two. The regression errors are not normally distributed and show signs of strong heteroscedasticity. Also, stationarity tests could not be conducted due to the short time period covered by the data.

5.4. Summary and relation to the literature

In essence, the results presented in section 5 show that an increased performance of MNEs is negatively related to the performance of domestic firms, which is in line with the theoretical predictions. However, this relation cannot be attributed to tax competition alone. Data limitations required the use of proxy variables, such that the contribution of tax competition to this relation could not be isolated accurately. Control variables captured some important exogenous factors, but there are numerous other factors that determine the nature of competition between MNEs and domestic firms. For instance, MNEs may have better access to human capital, as they are better able to recruit talent internationally. MNEs may also benefit from returns to scale, as large investments in capital can be spread across various subsidiaries. On the other hand, domestic firms may enjoy various advantages over MNEs, such as better knowledge of local markets. Also, MNE presence may be a boon to incumbent (domestic) firms, as these may be integrated in the MNEs global value chain by providing intermediate goods or supporting services, rather than be driven out of the market. The examples mentioned above illustrate how the regression outcomes summarised in sections 5.1 and 5.2 may be affected by a variety of factors other than international tax competition, that cannot all be controlled for. In other words, the independent variable coefficients should be interpreted as a measure of the net effect of competition between MNEs and domestic firms, controlled for the general and industry level economic environment.

Another consequence of the lack of valid data is the failure to accurately distinguish between MNEs and domestic firms within a country's manufacturing industry. Model two, included to account for this, did not yield significant results. The lack of significant t values and the low R^2 values signal that the number of firms is not a suitable measure of firm performance in the context of this study. A potential explanation for this is the fact that a firm's decision to enter or exit a market is not influenced, or influenced to a limited extent, by the competition with MNEs. An increased presence of MNEs within the manufacturing industry may still affect the performance of domestic firms, but the impact may not be large enough to cause domestic firms to exit the market. The impact of the tax induced competitive advantage does therefore not translate to a decrease in the number of active domestic firms within an industry. This explanation is merely a speculation, but it would explain why model one yielded a negative and significant independent variable coefficient while model two did not.

The findings presented in this section cannot be placed in the perspective of existing literature, as there seem to be no previous empirical studies on the effect of international tax competition on domestic firms on a national level. However, the empirical results can be placed in the context of literature on tax international tax competition in general. From this broader perspective, the findings of this study are largely in line with earlier research. The consequences of international tax competition and tax avoidance can be determined through reasoning, but empirical evidence is scarce due to limited data availability. This lack of valid data is driven by the inherently nontransparent nature of tax avoidance and tax competition. Within this context, this study is no exception. Data limitations required the adoption of proxy variables, which do not accurately capture the relation under study. Control variables are included, but these cannot account for all exogenous factors that affect the relation between MNE and domestic firm performance.

In short, this study yielded results that are in line with the theoretical foundation outlined in section 2. This foundation describes a negative effect of MNE presence on the performance of domestic firms, driven by a tax induced competitive advantage the former holds over the latter. However, the quality of the data means that these results require several caveats and are no conclusive evidence of the negative effect that international tax competition imposes on domestic firms.

6. Conclusions

The objective of this study is twofold. On the one hand, it aims to identify a negative effect of international tax competition on domestic firms. This aim is summarised in the research question posed in section 1: "*Do MNEs enjoy a tax induced competitive advantage over domestic firms, and to which extend does this competitive advantage affect the performance of domestic firms?*". On the other hand, this study emphasises the negative implications of international tax competition by explaining how this phenomenon affects both governments and firms through foregone tax revenues and distorted competition. These two objectives have been partially fulfilled. As shown in section 5, the main model used in this study yielded significant results, supporting the notion that domestic firms are indeed negatively affected by international tax competition. The significance of the results is not enough to draw definitive conclusions however. Although the empirical findings support the theory, the sample on which the results are based did not accurately capture the two types of firms identified in this study: tax avoiding MNEs and domestic firms. Furthermore, the lack of valid data required several reasonable but strong assumptions regarding the type of firms that benefited from international tax competition and the extent to which they did. A definitive answer to the research question can therefore not be provided. The second objective is defined less clearly, but can be considered fulfilled as the empirical results

indicate the existence of some negative relation between MNE and domestic firm performance. Combined with the theoretical foundation of this study, which describes how tax competition affects both firms and governments, the findings underscore that international tax competition is a problem with widespread consequences. In sum, this study should be interpreted as a first step in identifying how international tax competition distorts competition on a national level.

As explained above, this research does not yield specific policy recommendations, nor does it accurately estimate the impact of international tax competition on MNEs and domestic firms. Instead, this study outlines the difficulties that arise in researching the phenomenon of international tax competition in an attempt to guide future research in this particular area. The practical relevance of this study is therefore limited to the fact that it draws attention to the issue of international tax competition, and that it illustrates the difficulty of conducting research in this area due to a lack of transparency. Given that the relevance of this study is primarily derived from its assessment of the methodology required to study (the effects of) international tax competition, several suggestions for further research are in order. Although this study found statistically significant results, the relevance of these results is reduced by a number of assumptions regarding which firms benefited from international tax competition, and which didn't. In order to yield conclusive results, future research should therefore reduce the number of assumptions. The number of assumptions can be reduced in two steps. First, studies can adopt a more narrow focus by considering only the relation between international tax competition and the monetary benefit to the firms that are able to use this competition to their advantage. Once the benefit from tax avoidance is quantified, its effect on competition should then be considered in a separate study. Determining the monetary benefit of tax competition separately should shed more light on which firms are able to reduce their tax burden through an international fiscal strategy, and on the benefits it yields. The second point is that studies should adopt a firm rather than an industry level perspective. This would require more detailed data however. Obtaining these data is difficult, but not impossible, as illustrated by Davies et al. (2014). Firm level data allow for a clearer distinction between which firms use tax avoidance strategies, and which don't.

To give a practical example of the two points summarised above, consider the following research suggestion. A study comparing the cost of capital of two types of firms: those that use international fiscal structures to benefit from international tax competition, and those that are bound to the tax rate in their home country. A detailed sample containing firm level data should allow for a clear distinction between these two types of firms. Tax avoidance lowers a firm's overall cost of capital, meaning that a statistically significant difference in cost of capital between the two types of firms indicates the existence of a

competitive advantage. The benefit of using the cost of capital is that it is a relatively simple measure, determined only by the risk-free interest rate, tax levels and a company's risk premium. The simplicity of cost of capital compared to a measure like turnover means that it is less sensitive to (short-term) fluctuations in firm performance driven by various exogenous and endogenous factors. Second, there is a strong link between tax levels and the cost of capital. Obtaining favourable tax treatment is an integral part of a company's capital management, judging from the extent to which tax avoidance strategies seem to be adopted by internationally operating enterprises. This means that a relation between tax competition and firm performance should be more pronounced when measured in terms of the cost of capital compared to a measure like turnover. Its relative simplicity and strong relation to taxation thus make the cost of capital a measure that captures the effect of international tax competition more efficiently.

In summary, this study has provided several new insights, most of which are related to the methods that should be applied in further research on the implications of international tax competition. It has shed light on a particular phenomenon, namely the negative effect of international tax competition on the firms that are not able to benefit from it. This issue deserves attention and should be studied in greater detail.

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Appendix

Table 1 Overview of all countries that are both a member of the European Union and the OECD, for which the OECD provides data. Greece and Luxembourg, both denoted in italics, were excluded from the datasets used in this study. Also, the number of SMEs, LEs and MNEs in the manufacturing industry is given for each of the countries in the dataset. Values are expressed as a percentage share of the total number of enterprises in each country. All values in this table are calculated as a country's industry average over the period 2008-2014.

country	SMEs (% of total)	LEs (% of total)	MNEs (% of total)
Austria	98,19	1,81	4,01
Belgium	99,09	0,88	1,41
Czech Republic	99,53	0,47	2,21
Denmark	98,78	1,22	3,40
Estonia	98,97	1,03	5,35
Finland	99,04	0,96	2,05
France	99,30	0,70	1,88
Germany	97,96	2,04	2,61
Greece	*99,83*	*0,17*	*0,26*
Hungary	99,23	0,77	4,55
Ireland	99,09	0,91	2,94
Italy	99,70	0,30	0,69
Latvia	99,31	0,68	4,93
Luxembourg	*96,90*	*3,10*	*32,48*
Netherlands	99,32	0,68	2,95
Norway	99,29	0,71	3,05
Poland	99,14	0,86	1,5
Portugal	99,65	0,35	1,09
Slovak Republic	99,44	0,56	1,98
Slovenia	99,32	0,68	2,85
Spain	99,56	0,44	1,00
Sweden	99,37	0,63	2,95
UK	98,87	1,13	3,05

Table 2 Regression results of model two. ***, ** and * indicate significance on the 1%, 5% and 10% level respectively. The determination of significance is based on one-sided t tests.

Variables (log)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Dependent variable: ΔDOMnr							
Constant	-0.001	-0.004	-0.003	0.019	0.041	0.078	0.044
	(-0.01)	*(-0.04)*	*(-0.03)*	*(0.19)*	*(0.46)*	*(1.18)*	*(0.74)*
ΔMNEnr	-0.454	-0.453	-0.465	-0.442	-0.500	-0.446	-0.510
	(-0.81)	*(0.81)*	*(-0.88)*	*(-0.85)*	*(-0.99)*	*(0.90)*	*(-1.03)*
ΔDOMturn	2.804	2.815	2.816	2.805	2.662	2.679	2.803
	*(3.86)***	*(3.95)***	*(3.99)***	*(4.01)***	*(4.14)***	*(4.19)***	*(4.44)***
ΔMAN	-2.380	-2.381	-2.379	-2.539	-2.960	-3.155	-3.106
	*(-1.69)**	*(-1.71)**	*(-1.73)**	*(-1.92)**	*(-2.77)***	*(-3.11)***	*(-3.05)***
ΔCPI	-5.722	-5.770	-5.751	-6.103	-6.659	-6.198	-4.835
	*(-1.86)**	*(-1.91)**	*(-1.94)**	*(-2.14)***	*(-2.52)***	*(-2.45)***	*(-2.18)***
ΔMNEturn	0.496	0.491	0.495	0.528	0.547	0.497	0.565
	(1.01)	*(1.01)*	*(1.04)*	*(1.13)*	*(1.19)*	*(1.10)*	*(1.26)*
ΔGDP	2.847	2.839	2.838	2.839	2.777	3.243	1.236
	(1.02)	*(1.03)*	*(1.04)*	*(1.04)*	*(1.03)*	*(1.26)*	*(0.67)*
ΔnrMNE1	0.297	0.295	0.273	0.320	0.344	0.397	0.293
	(0.50)	*(0,50)*	*(0.54)*	*(0.65)*	*(0.70)*	*(0.83)*	*(0.62)*
ΔCONS	-3.740	-3.618	-3.595	-3.436	-3.509	-3.208	
	(-1.15)	*(-1.19)*	*(-1.20)*	*(-1.17)*	*(-1.20)*	*(-1.12)*	
ΔEARN	2.621	2.688	2.664	1.970	1.686		
	(0.80)	*(0.84)*	*(0.84)*	*(0.71)*	*(0.62)*		
ΔIM	-0.203	-0.323	-0.325	-0.265			
	(0.18)	*(-0.63)*	*(-0.64)*	*(-0.55)*			
ΔGCI	-1.722	-1.685	-1.682				
	(-0.47)	*(-0.47)*	*(-0.47)*				
ΔnrMNE2	0.039	0.035					
	(0.08)	*(0.07)*					
ΔEX	-0.135						
	(-0.12)						
Fixed effects	yes	yes	yes	yes	yes	yes	yes
R^2	0.360	0.359	0.360	0.344	0.314	0.281	0.247

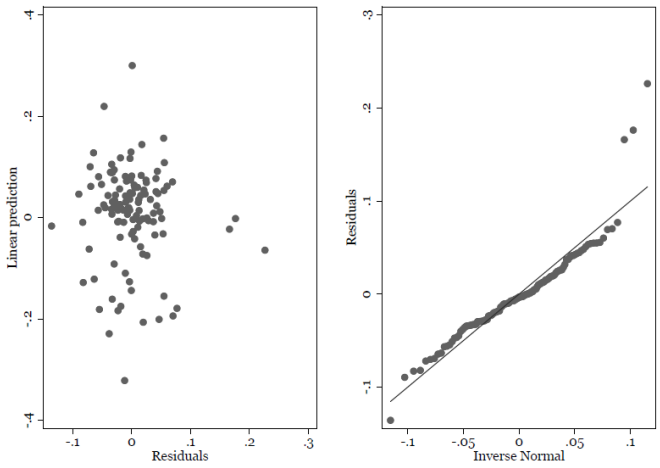
Variables (log)	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
Dependent variable: ΔDOMnr						
Constant	0.051	0.058	0.072	-0.010	-0.045	0.031
	(0.89)	*(1.04)*	*(1.30)*	*(-0.27)*	*(-1.29)*	*(1.03)*
ΔMNEnr	-0.635	-0.577	-0.413	-0.283	-0.008	0.033
	(-1.41)	*(-1.33)*	*(-0.98)*	*(-0.67)*	*(-0.02)*	*(0.07)*
ΔDOMturn	2.809	2.881	2.867	2.733	1.690	
	*(4.48)***	*(4.72)***	*(4.66)***	*(4.37)***	*(3.46)***	
ΔMAN	-3.102	-2.954	-2.295	-2.166		
	*(-3.07)***	*(-3.04)***	*(-2.71)***	*(-2.51)**		
ΔCPI	-4.848	-4.809	-4.107			
	*(-2.20)**	*(-2.20)**	*(-1.92)**			
ΔMNEturn	0.605	0.593				
	(1.37)	*(1.36)*				
ΔGDP	1.019					
	(0.56)					
ΔnrMNE1						
ΔCONS						
ΔEARN						
ΔIM						
ΔGCI						
ΔnrMNE2						
ΔEX						
Fixed effects	yes	yes	yes	yes	yes	yes
R^2	0.239	0.231	0.245	0.223	0.200	0.005

Table 3 Results of a Fisher-type unit root test conducted on each variable in model one, with a null hypothesis of stationarity. Significant chi-squared statistics are indicated with ***, ** and * for significance on the 1%, 5% and 10% level respectively.

Variable	Inverse chi-squared
ΔDOMturn	225.306***
ΔMNEturn	169.876***
ΔMAN	140.918***
ΔIM	85.626***
ΔDOMnr	182.7812***
ΔCPI	179.193***
ΔGDP	88.798***
ΔMNEnr	203.937***
ΔCONS	233.496***
ΔEX	163.244***
ΔEARN	527.488***
ΔGCI	96.3377***

Table 4 Results of a Fisher-type unit root test conducted on each variable in model two, with a null hypothesis of stationarity. Significant chi-squared statistics are indicated with ***, ** and * for significance on the 1%, 5% and 10% level respectively.

Variable	Inverse chi-squared
ΔDOMnr	0.000
ΔMNEnr	0.000
ΔDOMturn	0.000
ΔMAN	0.000
ΔCPI	0.000
ΔMNEturn	0.000
ΔGDP	0.000
ΔnrMNE1	0.000
ΔCONS	0.000
ΔEARN	0.000
ΔIM	0.000
ΔGCI	0.000
ΔnrMNE2	0.000
ΔEX	0.000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Residuals
Inverse Normal
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-.1
-.05
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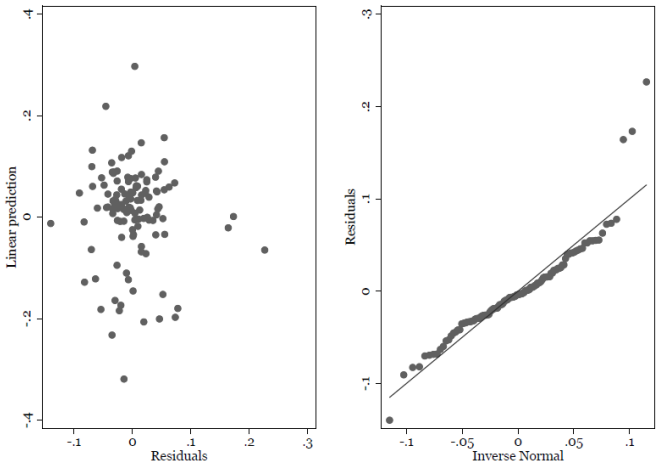
.05
.1

1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Residuals
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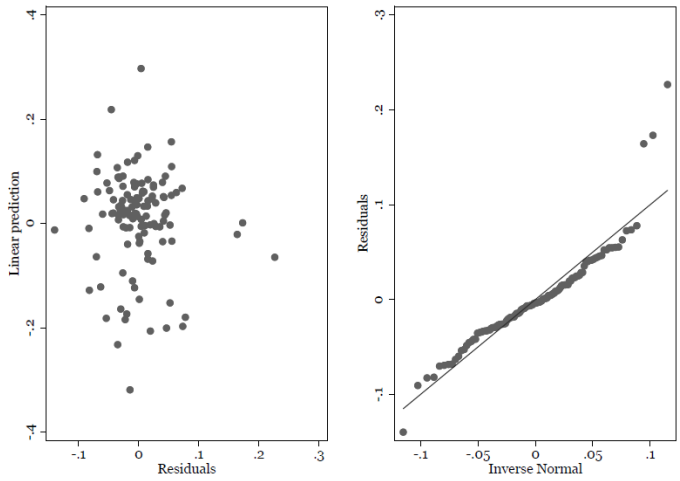
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Residuals
Inverse Normal
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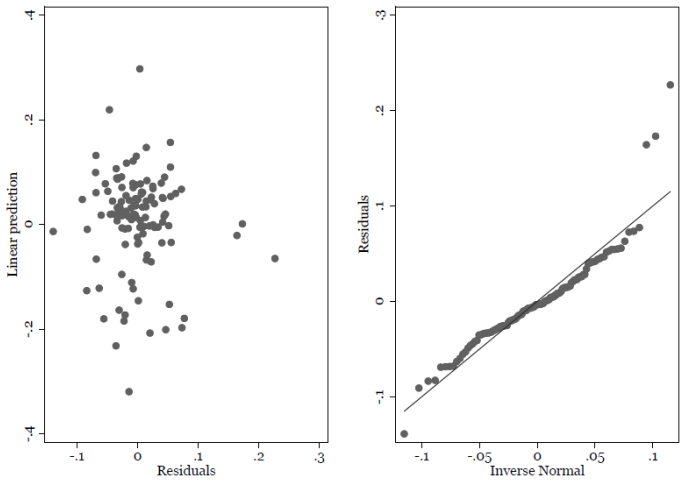
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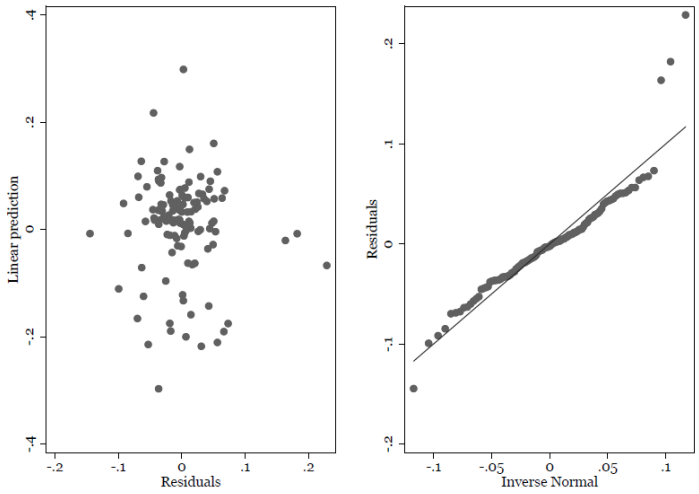
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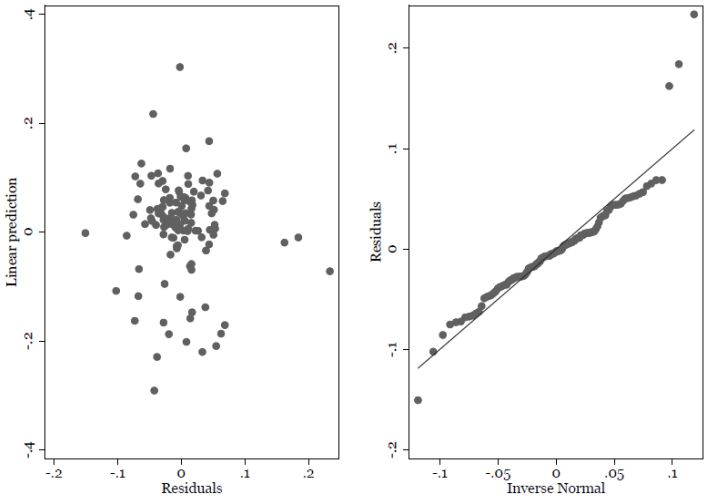
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Residuals
Inverse Normal

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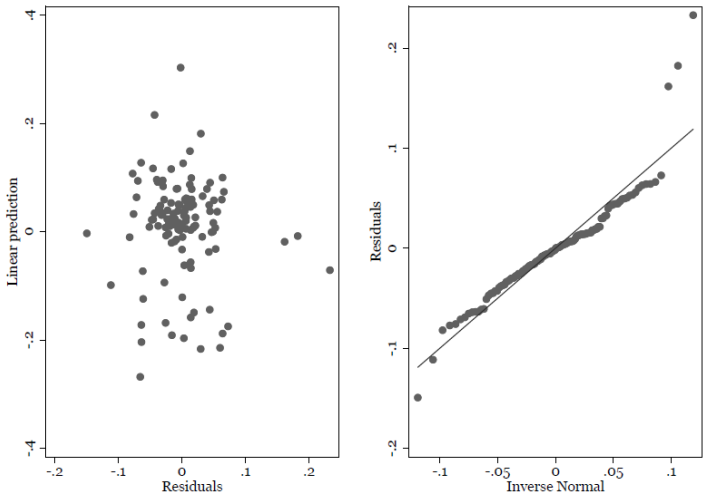
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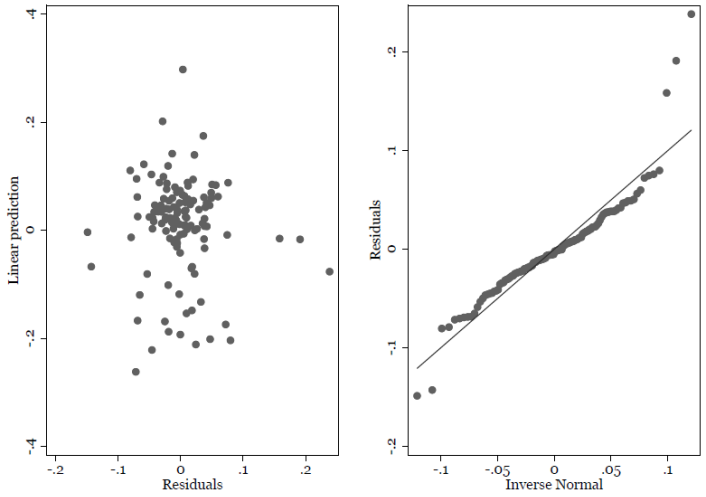
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Residuals
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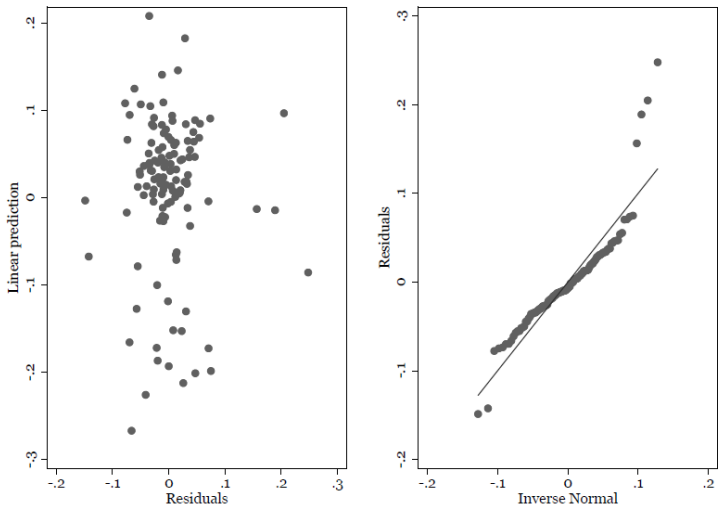
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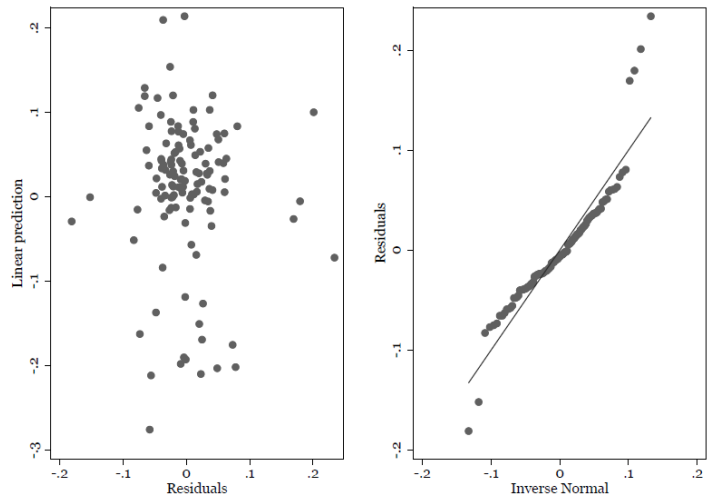

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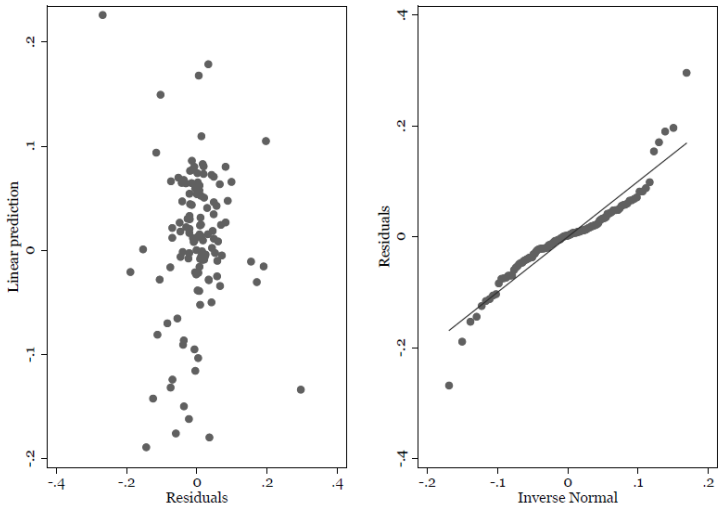
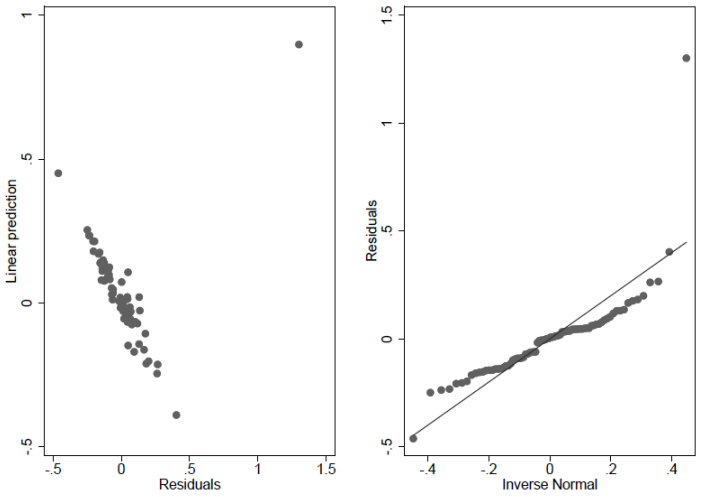


11

Figure 1 Residuals versus predictor plots (left) and quantiles plots (right) used to identify heteroscedasticity and non-normality in the regression residuals of model one. The panel numbers 1-11 correspond to the column numbers 1-11 in table 1 in section 5.1.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Residuals
Inverse Normal
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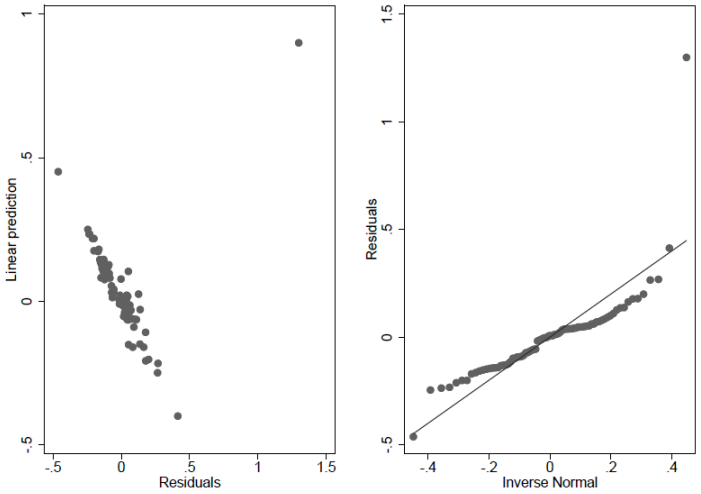
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Residuals
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0
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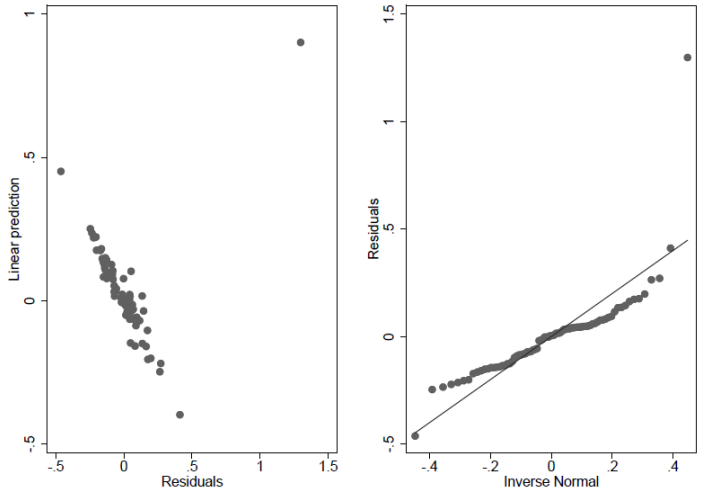
.4

2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Residuals
Inverse Normal
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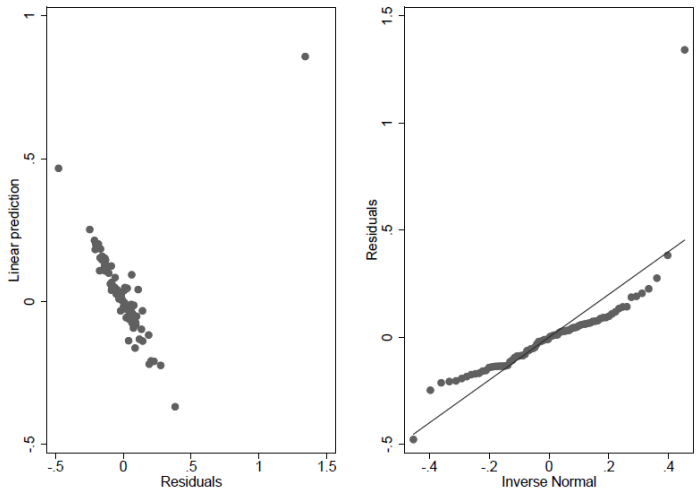
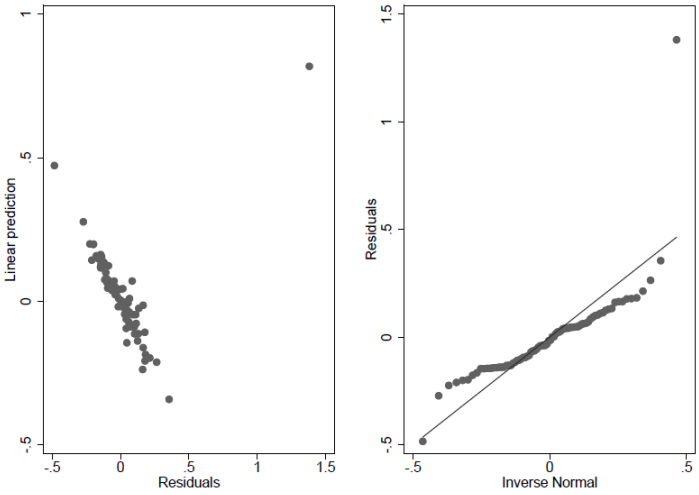
-.2
0
.2
.4

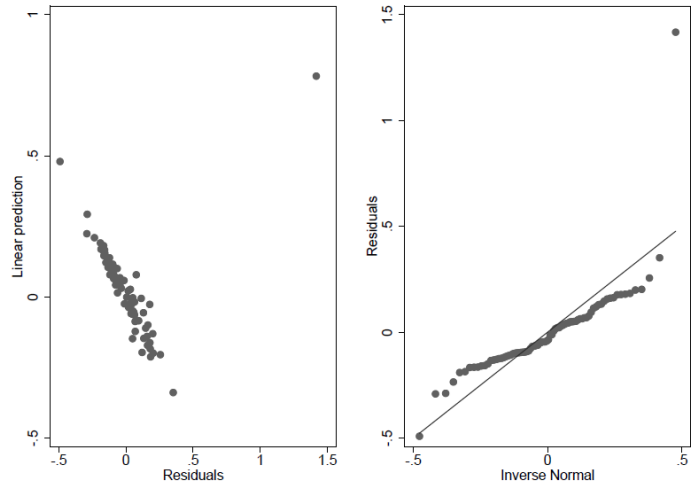
3


Linear prediction
Residuals
Residuals
Inverse Normal

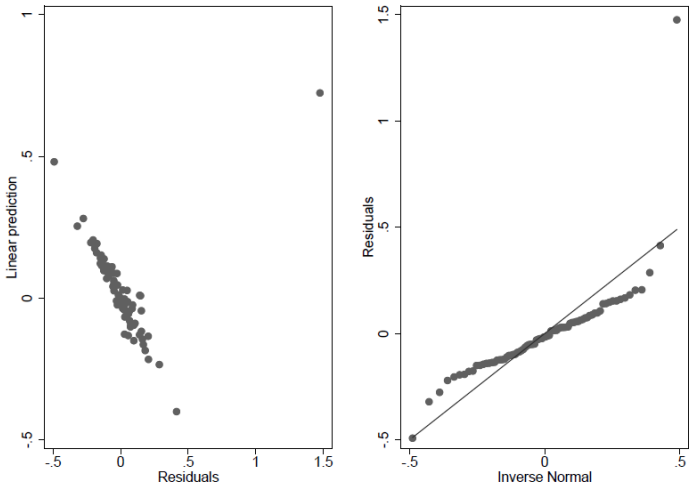
4


Linear prediction
Residuals
Residuals
Inverse Normal

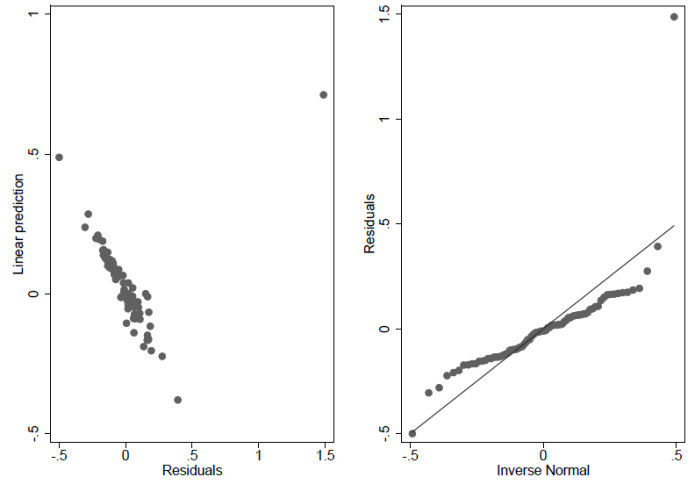
5


Linear prediction
Residuals
Residuals
Inverse Normal

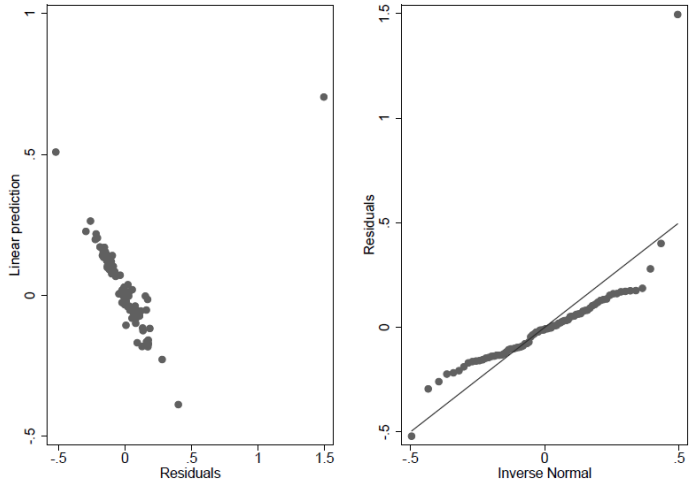
6


Linear prediction
Residuals
-.5
0
.5
1
1.5
Residuals
Inverse Normal

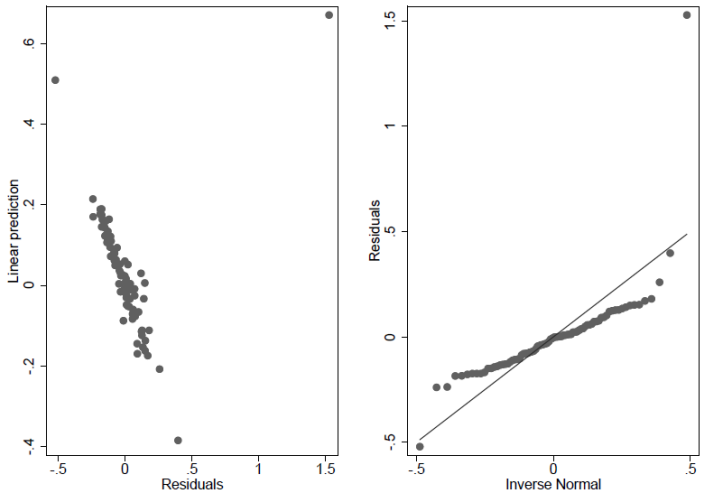
7


Linear prediction
Residuals
-.5
0
.5
1
1.5
Residuals
Inverse Normal

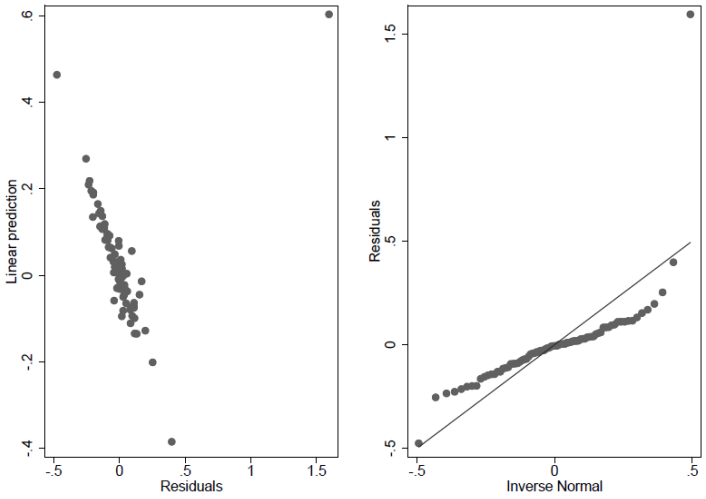
8


Linear prediction
Residuals
-.5
0
.5
1
1.5
Residuals
Inverse Normal

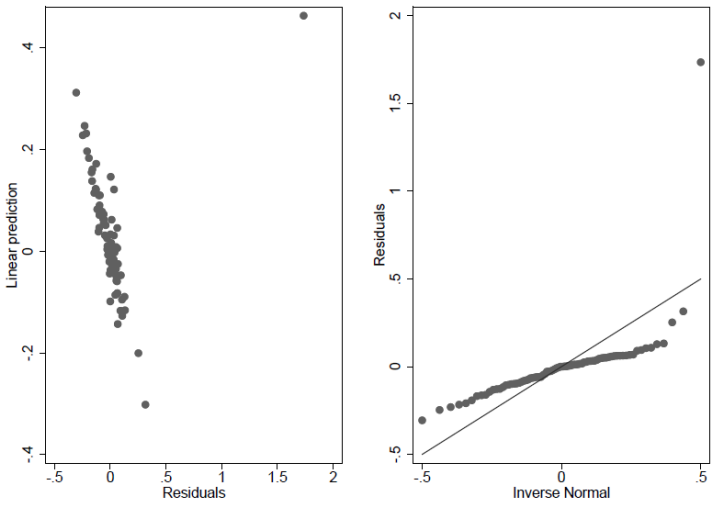
9


Linear prediction
Residuals
Residuals
Inverse Normal

10


Linear prediction
Residuals
Residuals
Inverse Normal

11


Linear prediction
Residuals
Residuals
Inverse Normal

12

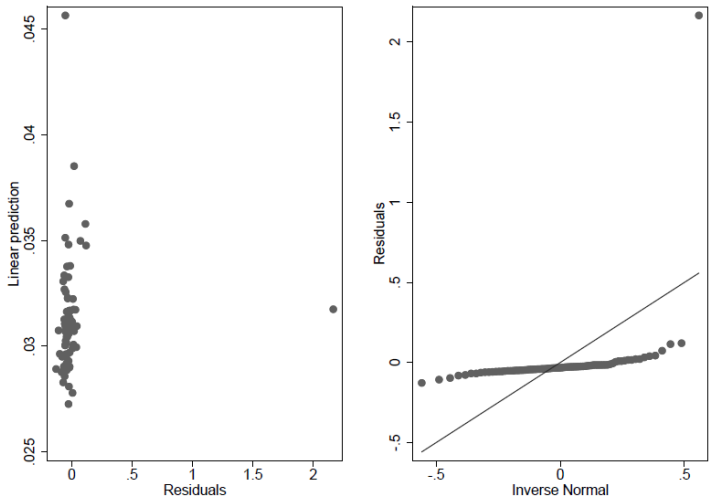


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Figure 2 Residuals versus predictor plots (left) and quantiles plots (right) used to identify heteroscedasticity and non-normality in the regression residuals of model two. The panel numbers 1-13 correspond to the column numbers 1-13 in table 2 in the appendix.