DEUTSCHE
BUNDESBANK

How would formula apportionment in the EU affect the distribution and the size of the corporate tax base? An analysis based on German multinationals

Clemens Fuest
(University of Cologne)

Thomas Hemmelgarn
(University of Cologne)

Fred Ramb
(Deutsche Bundesbank)

Discussion Paper
Series 1: Economic Studies
No 20/2006

Deutsche Bundesbank, Wilhelm-Epstein-Strasse 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-1
Telex within Germany 41227, telex from abroad 414431, fax +49 69 5601071

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax +49 69 9566-3077

ISBN 3–86558–165–X (Printversion)
ISBN 3–86558–166–8 (Internetversion)

Abstract:

This paper analyses the effects of introducing a common EU tax base with formula apportionment on the size of the EU wide tax base and on the distribution of the tax base between the EU member countries. We use a combined dataset of Deutsche Bundesbank's Foreign Direct Investment data (MiDi) and corporate balance sheet data (Ustan and Hoppenstedt) for the tax base estimations. The data is used to construct i) a separate accounting and ii) a formula apportionment tax base for the firms in the sample. Our results suggest that due to border crossing loss-offset, the EU wide corporate tax base represented by our data sample shrinks significantly. Smaller countries which are usually considered to attract book profits under the current system, i.e. Ireland and the Netherlands, tend to lose a larger part of their tax base than larger countries like Germany, Italy, France or Great Britain. However, these results should be evaluated in the light of the limitations of the data used in this study since our analysis is based on German FDI data only. Furthermore, the calculations do not take into account behavioural responses of companies caused by such a system change.

Keywords: EU Tax Base, Formula Apportionment, Multinational Companies

JEL-Classification: F23, H25

Non-Technical Summary

In its 2001 report on company taxation in the internal market, the EU commission proposed the introduction of a common European tax base which would be apportioned to the member states according to some formula which accounts for economic activity in terms of sales, property and employment. A common tax base is meant to reduce the compliance costs of multinational companies caused by having to deal with many different national tax rules and moreover to limit the possibility to shift book profits by using transfer prices.

This paper is a first approach to analyse the effects of introducing a common EU tax base with formula apportionment on the size of the EU wide tax base and the distribution of the tax base between the EU member countries. This is a difficult task since there is no database available for Europe as a whole. For this reason we concentrate on German data in our approach. Note that we can only analyse the part of an EU tax base that is made up by German companies and their foreign affiliates. Such an approach is justifiable if we assume that the distribution of losses and profits of German multinational companies is similar to that of multinational companies from other EU countries.

We use a combined dataset of Deutsche Bundesbank's Foreign Direct Investment data (MiDi) and corporate balance sheet data (Ustan and Hoppenstedt) for the tax base estimations. The data is used to construct i) a separate accounting tax base and ii) a formula apportionment tax base for the sample period 1996 to 2001. We compare these two tax bases for each country and for the EU15.

The results suggest that smaller countries, in particular those which are usually considered to attract book profits under the current system, i.e. Ireland, Belgium, and the Netherlands, lose a significant part of their tax base, while larger countries lose less tax base. If only the effect of formula apportionment without a loss-offset is analysed, large countries tend to gain from formula apportionment, while small countries lose tax base. This reflects that, under the current system, the share of the larger countries in the

common tax base is small, relative to their share in real economic activity as measured by apportionment factors like property, sales, and employees.

Next to the distributional change of the tax bases between member countries, there is also an effect on the overall size of the European tax base. The introduction of a consolidated EU tax base would entail a reduction in the overall tax base because such a system would imply an EU wide loss-offset for multinational companies. In our sample, the overall tax base declines significantly.

These results should be evaluated in the light of the limitations of the data used in this study since our analysis is based on German FDI data only and does not take into account behavioural responses of companies due to a system change. Therefore, the analysis considers only one part of an EU tax base, namely the part that is made up of German multinational companies and their subsidiaries. Finally, the analysis uses only data on German investments in the EU15, i.e. those countries that were EU members before May 1st, 2004.

Nicht-technische Zusammenfassung:

Die EU-Kommission hat in ihrem Bericht zu Unternehmensbesteuerung im europäischen Binnenmarkt aus dem Jahre 2001 den Vorschlag gemacht, eine einheitliche europäische Bemessungsgrundlage für europaweit tätige Unternehmen zu schaffen. Eine solche einheitliche Bemessungsgrundlage soll nach Vorstellung der EU-Kommission anhand einer bestimmten Zuteilungsformel auf die Länder verteilt werden. Die Faktoren in der Formel sollen die Aktivität der jeweiligen Unternehmen in den Ländern berücksichtigen. Mögliche Zuteilungsfaktoren, die die ökonomische Aktivität eines Unternehmens in einem Land messen, wären etwa die Umsätze, die Sachanlagen oder die Lohnsumme eines Unternehmens. Eine solche einheitliche EU-Bemessungsgrundlage soll die Anreize zu Gewinnverschiebungen der Unternehmen reduzieren und vor allem die Kosten der Unternehmen senken, die durch den Umgang mit 25 verschiedenen Steuersystemen in der EU entstehen.

Die vorliegende Arbeit unternimmt einen ersten Versuch, den Effekt der Einführung einer solchen einheitlichen EU-Bemessungsgrundlage und der damit verbundenen Zuteilungsregeln auf die Höhe der Bemessungsgrundlage und ihre Verteilung auf die EU-Mitgliedsländern zu messen. Dieser Versuch wird durch die Datenlage erschwert, denn zurzeit liegen keine Daten eines repräsentativen Ausschnitts europäischer multinationaler Unternehmen vor. Daher werden in diesem Aufsatz nur Daten deutscher multinationaler Unternehmen mit ausländischen Töchtern in der EU verwendet. Ein solches Vorgehen ist vertretbar, wenn man davon ausgeht, dass multinationale Unternehmen aus anderen Mitgliedsländern eine ähnliche Gewinn- und Verlust-Verteilung aufweisen und es somit möglich ist von den Ergebnissen für deutsche multinationale Unternehmen auf EU-weite Effekte zu schließen.

Zur Berechnung der Effekte wird ein kombinierter Mikro-Datensatz auf Firmenebene benutzt, der sich aus der Mikrodatenbank Direktinvestitionen (MiDi) der Deutschen Bundesbank und Unternehmensbilanzstatistiken (Ustan und Hoppenstedt) zusammensetzt. Mit diesen Daten für die Jahre 1996 bis 2001 berechnen wir die Bemessungsgrundlage im Status Quo und die Bemessungsgrundlage für den Fall einer

einheitlichen EU-Bemessungsgrundlage mit Zuteilungsfaktoren, die wir ebenfalls aus dem Datensatz berechnen.

Ein Vergleich der Zahlen für beide Szenarien zeigt, dass in der Tendenz kleine Länder und insbesondere die kleineren Länder, die gemeinhin als attraktive Gastländer für Buchprofite gelten, in einem System mit Zuteilungsformel stärker verlieren als große Länder. Der Grund hierfür ist, dass in dem in unserem Sample betrachteten Zeitraum große Länder im System getrennter Buchführung eine zu geringe Bemessungsgrundlage erhalten, wenn man die ökonomische Aktivität im Land für eine Zuteilung einer einheitlichen Bemessungsgrundlage zugrunde legt. Diese Beobachtung bestätigt sich, wenn wir die Zuteilungsformel ohne die Berücksichtigung einer internationalen Verlustverrechnung anwenden. In diesem Fall gewinnen die großen Länder oder stellen sich zumindest nicht schlechter, während die kleineren Länder zum Teil deutlich verlieren.

Neben der neuen Verteilung des Steueraufkommens zeigt sich auch ein deutlicher Effekt auf die Summe der Steuerbemessungsgrundlagen aller Länder. Die Einführung einer einheitlichen Basis würde in unserem Datensatz zu einem Rückgang der gesamten Bemessungsgrundlage führen. Der Grund hierfür ist, dass bei einer EU-Bemessungsgrundlage ein internationaler Verlustausgleich der Unternehmen möglich ist, der die Bemessungsgrundlage reduziert.

Diese Ergebnisse müssen jedoch angesichts der sehr schwierigen Datengrundlage vorsichtig bewertet werden. Es stehen nur Daten für deutsche multinationale Unternehmen und deren Tochterfirmen zur Verfügung und dies auch nur für einen begrenzten Zeitraum, der möglicherweise nicht repräsentativ ist. Wir betrachten somit nur einen Ausschnitt einer EU Bemessungsgrundlage, nämlich den Teil, der von deutschen multinationalen Unternehmen im betrachteten Zeitraum gebildet wird. Eine Verbesserung der Datenlage für die Berechnung europäischer Steuerfragen wäre daher sehr wünschenswert, um robustere Aussagen über die Entwicklung des Steueraufkommens machen zu können. Die Daten werden nur für die Länder berechnet, die vor dem 1. Mai 2004 Mitglieder der EU waren. Zusätzlich können mit diesen rückblickenden Daten keine Verhaltensänderungen der Unternehmen abgebildet werden, die bei einem solchem Systemwechsel zu erwarten sind.

Contents

List of tables and figures

How would formula apportionment in the EU affect the distribution and the size of the corporate tax base? An analysis based on German multinationals.*

1. Introduction

For decades, proposals to coordinate corporate income taxes in the European Union (EU) have been largely unsuccessful because the member countries refused to give up national sovereignty in the field of direct taxation. But recently, at an informal ECOFIN meeting in September 2004, the finance ministers of the EU countries supported the creation of a working group dealing with corporate tax base harmonisation. Since November 2004 the so called Common Consolidated Corporate Tax Base Working Group has started to investigate concepts for introducing a common European tax base.

The most likely reason for this policy shift is that national governments in the EU find it increasingly difficult to tax the income of multinational corporations (MNC) in a satisfactory way. Next to the pressures implied by tax competition for real investment, countries with high tax rates increasingly observe that profits generated domestically are shifted to low tax jurisdictions through transfer pricing, thin capitalization and other income shifting techniques.[1] For some time, national governments tried to tackle this problem via anti tax avoidance legislation. But this legislation is increasingly challenged by the European Court of Justice (ECJ).[2] The fading power to tax at the national level may have induced governments to give up resistance against tax coordination at the European level.

---

* Authors' affiliations: Clemens Fuest, University of Cologne, Department of Economics, Albertus-Magnus-Platz , D-50923 Cologne, Thomas Hemmelgarn, University of Cologne, Department of Economics, Albertus-Magnus-Platz, D-50923 Cologne, Fred Ramb, Deutsche Bundesbank, Economic Research Centre, Wilhelm-Epstein-Straße 14, D-60431 Frankfurt am Main. This paper represents the authors' personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank or its staff. We thank Heinz Herrmann, Jana Kremer, Alfons Weichenrieder, and the participants of the Deutsche Bundesbank FDI Workshop held on September, 13th 2005 in Frankfurt for their valuable comments.

[1] For a survey on the tax competition literature see Fuest, Huber and Mintz (2005). A survey on the empirical literature on tax competition can be found in De Mooij and Ederveen (2003). Desai, Hines and Foley (2003) survey different studies that show empirical evidence for profit shifting. One should note that also losses could be shifted from low tax to high tax countries in order to reduce the tax burden.

[2] See Persoff (2004) for a survey on the relevant ECJ rulings.

In its 2001 report on company taxation in the internal market, the EU commission proposed the introduction of a common European tax base which would be apportioned to the member states according to a formula which is yet to be specified.[3] Such an EU tax base would replace the separate accounting (SA) system for MNC.[4] While the tax base would be harmonized, the EU member countries would retain the right to set tax rates. Each country would apply the national tax rate to its share of the common tax base.

An important problem that policy makers face when proposing changes to the national tax system is to estimate the tax revenue effects. For purely national tax reforms, sophisticated methods and data sources are available to estimate the revenue effects. But for an EU wide reform of company taxation, the available information on the revenue effects for the different member countries is rather limited.

The goal of this paper is to shed some light on the possible revenue effects of an EU tax base with formula apportionment (FA).[5] We focus on the change of the overall tax base and the redistribution of tax bases between countries implied by a switch from SA to FA. Our analysis is based on German firm-level FDI data in combination with balance sheet information on the parent companies. Since German companies with foreign subsidiaries are legally obliged to report the balance sheet positions of subsidiaries to Deutsche Bundesbank, information on foreign profits, losses, property and sales is available. In principle, it would of course be desirable to use data from EU-wide and not just German MNCs. The problem is that, to the best of our knowledge, no EU wide data base of comparable quality is available.[6] Moreover, as we show in greater detail in section 2, German foreign direct investment does constitute a significant part of overall foreign direct investment in the EU. Nevertheless, it is clear that the limitations of our database have to be taken into account when interpreting our results.

---

[3] For a more detailed analysis of the advantages and shortcomings of formula apportionment see Mintz and Weiner (2003).

[4] The proposals discussed at the moment would allow companies to choose between the existing system and the EU tax base.

[5] The term "formula apportionment" is common in the United States, while the term "formula allocation" is mainly used in Canada. Some authors also use "formulary apportionment". We will use the U.S. term formula apportionment here.

[6] Note e.g. that 50% of the data we use is taken from income tax statements whereas most other available datasets are based on financial statements. The data is described in greater detail in section 2.

The data is used to estimate the firm-level apportionment factors and the SA and FA tax bases for our sample of German multinational companies and their subsidiaries. Our simulation of the FA system proceeds in two steps. In the first step we only apportion the profits according to the formula but do not allow for border crossing loss offset. In the second step we add an EU-wide loss-offset.[7] This allows us to distinguish the impact of profit distribution according to the formula and the impact of loss offset.

Our analysis yields the following main results: If an FA system without border crossing loss-offset is introduced, many smaller countries, in particular those which are usually considered to attract book profits under the current system, tend to lose part of their tax base. At the same time, the tax base of large countries increases or at least remains the same, compared to the SA case. Adding border crossing loss-offset to the FA system implies that most lose tax base. This happens because the EU wide corporate tax base declines. In our sample this reduction amounts to about 20 percent.[8]

The result for the decline in the aggregate tax base should be interpreted with caution. This is not only because we only use data on German MNCs, which are unlikely to be representative of the EU as a whole. In our sample period (1996-2001) subsidiaries of German firms in other European countries experienced large losses, so that average profitability was relatively low.[9] These losses are also a reason for the tax base decrease when introducing an EU-wide tax base with loss-offset. It cannot be excluded that losses would be smaller if a longer period had been available.

In the literature, formula apportionment has been studied in both empirical and theoretical contributions. But, as far as we know, this paper is the first attempt to investigate the revenue effects of introducing FA in Europe. Shackelford and Slemrod (1998) discuss the revenue effect of a unilateral introduction of international formula apportionment at the federal level in the U.S. They find that the tax liabilities of US multinationals would increase with the introduction of FA in the USA. The difference to our analysis is that Shackelford and Slemrod (1998) do not allow for international loss-offset.

---

[7] For theoretical analysis of the effects of an international loss-offset see Gérard and Weiner (2003).
[8] Note that the tax base change is the same as the tax revenue change if we assume that the tax rates remain unchanged.
[9] See Weichenrieder and Ramb (2004).

We will not discus the theoretical arguments for and against the introduction of a common tax base with an FA system at length.[10] The main arguments in favour of such a system are the avoidance of transfer pricing rules,[11] the reduction of compliance costs and the simplification of tax rules for MNC.[12] The idea is that this might foster economic development in the European Union. This argument is put forward by the European Union itself and some researchers in this field.[13] On the other hand there are contributions that emphasize the role of incentives to avoid taxation and distortions in economic decisions of companies when using formula apportionment, which are not present in the current systems of separate accounting.[14]

The paper proceeds as follows. In Section 2 the database used in our estimations is presented and discussed. Section 3 describes the benchmark case with SA, and gives the estimations for the tax bases when SA is in place. Section 4 presents the characteristics of an EU tax base, while Section 5 presents the apportionment system that allocates a common tax base to the EU member countries. In Section 6 the estimation for an EU tax base is presented and compared to the results from Section 3. Section 7 concludes the paper.

2. Data

The most important prerequisite when estimating tax base effects is to find a representative database that contains the necessary information on corporate multinational companies. The calculation of the tax base effects when introducing a single European corporate tax base would ideally use data on all EU multinational companies and their foreign affiliates in Europe in order to generate precise and robust results. Unfortunately, a database that combines the information of parent companies from different EU countries and their foreign subsidiaries does not exist in Europe. Even on the national level most countries do not have information about domestic MNC

[10] There are many contributions to the literature dealing with this issue. See e. g. Gordon and Wilson (1986), Sorensen (2004), Mintz (1999), Weiner (1999), Mintz and Weiner (2003), Devereux (2004), Wellisch (2004) and Pethig and Wagener (2003).
[11] See Riedel and Runkel (2005) for a theoretical analysis of the effect of FA in a union with respect to the transfer pricing activities of companies with subsidiaries in a country outside the union.
[12] The compliance costs of international companies when dealing with the different EU tax systems have been analyzed by the European Commission (2004).
[13] See Mintz (2004) and European Commission (2004).
[14] See Gordon and Wilson (1986).

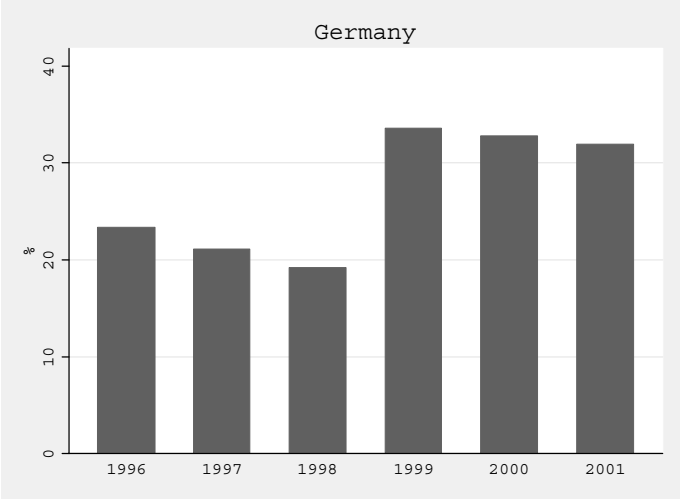
that can be combined with data on the foreign subsidiaries. Our paper is a first step to overcome this data problem. We use German data to create a backward looking database using information on German MNC and their EU subsidiaries.

The Deutsche Bundesbank carries out annual full sample surveys on inbound and outbound direct investment stocks based on the provisions of the Foreign Trade and Payments Regulation.[15] Since German companies have to report about their foreign investments to Deutsche Bundesbank there exists a rich database on the balance sheet information of the foreign subsidiaries of German MNC. We use this Micro Database Direct Investment (MiDi) and match it with two other data sources that give us information on the balance sheet information of the parent companies taken from the Deutsche Bundesbank's Ustan and the Hoppenstedt databases.[16] The matching process combines only the parent companies with the corresponding subsidiaries where the identification of the parent company is available. How much of overall German FDI abroad is described by this new sample? Figure 1 shows the share of the firms in our sample in total FDI stocks of German multinational companies in the EU15 countries. On average, they account for around 25 percent of total German FDI in the EU15.

The newly created database gives us a small part of the European tax base for the years 1996 to 2001: It allows us to balance losses and profits of German MNCs and their foreign subsidiaries.[17] The data restrictions allow us to do this only for MNCs based in Germany. But since no other database of comparable quality is available to our knowledge, and given that Germany is economically one of the most important EU countries, the data is a useful starting point for evaluating of possible tax base effects of a switch from SA to FA in the EU. A look at Eurostat FDI data shows that Germany`s share in total FDI stocks within the EU15 is about 14 percent.[18]

[15] See Lipponer (2003a, 2003b) and the appendix for a detailed description of the Micro Database Direct Investment.
[16] See the appendix for a detailed description of the data matching.
[17] Note that balancing profits and losses is not the same as consolidating the firm activities. Our data does not allow calculating a consolidation of profits. Our approach is similar to group taxation with an international loss-offset system.
[18] We used Eurostat data on FDI stocks (Position 505) for the years 1996 to 2001 to calculate this number.

Figure 1: Share of the parent companies in the sample in the total EU15 FDI stocks of German multinational companies for the period 1996-2001.



Next to the profits and losses we are also able to calculate the property, sales and the number of employees for each German MNC with subsidiaries in the EU15. Sales are defined as total external sales of a firm in one year including exports. The variable property is defined as the sum of all tangible and intangible assets of the firm. Instead of the payroll data used in current FA systems in Canada and the United States we only have information on the number of employees.[19] We use this number as a proxy for payroll. The profit of a firm is defined as the pre-tax profit of firms before dividends and after tax loss-carry forwards. We use the same positions for both the parent company and the subsidiary. Using the pre-tax profit is reasonable in this setting since we are interested in the tax base of a single firm.[20] The total assets are defined as the balance sheet total of the parent company.

The analysis is based on an unbalanced panel dataset with information about 1844 German parent companies and 5761 foreign subsidiaries.[21] The calculations are

[19] See the appendix for a detailed description.
[20] While the pre-tax profit is directly available for the German parent company we only have after tax profits for the subsidiaries. We used the statutory tax rates to estimate the pre-tax profits of subsidiaries. See the appendix for details.
[21] We exclude the agricultural sector and the public sector companies from the sample.

restricted to subsidiaries in the EU15, i.e. those countries which were EU member states before May 2004.[22]

Table 1 summarises the firm-level data of German firms and subsidiaries in the EU15 for the years 1996 to 2001. Firstly, it should be noted that the firms in the sample are very heterogeneous. The standard deviations are very large for most countries. The first column displays the mean profit of firms for each country (*mprofit*).[23] The mean of firm profits for German parent companies is at least one third higher than the mean profit of the affiliates in the other EU countries. Why is there a profit bias towards Germany? It should be noted that our panel is asymmetric with respect to the distribution of economic activity between Germany and the other countries. In terms of property, sales, and employees, the domestic activity of German parent companies is much larger than economic activity of subsidiaries abroad. This could explain that the profits reported by the parent companies are larger in absolute terms. The mean property in Germany (*mproperty*) is at least three times the size of other countries. The same is true for the mean of sales (*msales*) and the mean number of employees, which are, respectively, four and seven times higher in Germany than abroad.

Not surprisingly, the absolute number of firms in the sample is also highest in Germany since there are many parent companies with only one or two subsidiaries in the EU15. We also find a large number of firms in some smaller countries like the Netherlands and Belgium. These countries are known as preferred locations for headquarters of holding companies.[24] This could be a factor explaining the high number of observations. The geographical neighbourhood to Germany is likely to be another relevant factor for the location of FDI in our sample as the high number of firms in Austria indicates.

[22] We also estimated the tax bases for the EU25 in order to check if our results are robust to variations. The results are available upon request from the authors. The general results do not change when using the EU25. The decrease in the overall tax base is slightly higher. The countries in the EU15 that lose from introducing an FA system do not change when we use the data for the EU25. We do not report the results here since for the time period available the ten countries were not part of the EU which makes a comparison difficult.

[23] Note that loss carry forwards have been considered in these calculations.

[24] The issue of holdings and the structure of holding companies in Europe is discussed by Weichenrieder (2005).

Table 1: The mean of profit, property, sales (in thousand Euro), and pre-tax return on total assets per firm for the years 1996-2001

Country	mprofit	mproperty	Msales	memployees	Number of firms
Austria	818	8.880	46.688	173	702
	(22.114)	(45.412)	(156.264)	(497)	
Belgium	3.372	11.417	71.602	156	427
	(28.086)	(66.109)	(355.387)	(778)	
Denmark	245	4.344	29.076	100	208
	(6.649)	(16.095)	(69.128)	(237)	
Finland	1.345	8.107	22.581	68	195
	(5.964)	(38.744)	(56.847)	(177)	
France	1.050	10.427	90.259	230	993
	(49.848)	(52.142)	(653.058)	(868)	
Germany	8.560	66.202	378.836	1686	1.844
	(156.078)	(596.773)	(2.164.687)	(9483)	
Great Britain*	-10.210	17.295	80.785	245	790
	(223.247)	(135.137)	(510.215)	(1575)	
Greece*	-9	4.423	27.604	108	99
	(2.503)	(7.831)	(47.498)	(174)	
Ireland	2.503	5.560	17.103	90	110
	(14.733)	(18.540)	(39.054)	(194)	
Italy	1.999	9.551	56.082	137	609
	(14.349)	(43.574)	(243.091)	(392)	
Luxemburg*	-4.973	11.115	26.068	83	95
	(158.101)	(40.902)	(58.859)	(154)	
Netherlands	6.954	9.834	35.800	109	611
	(162.486)	(53.486)	(102.136)	(238)	
Portugal	1.267	17.314	49.121	225	186
	(10.817)	(84.595)	(189.388)	(526)	
Spain	2.415	11.174	55.832	207	545
	(17.554)	(56.575)	(255.940)	(745)	
Sweden	3.717	20.056	68.260	225	256
	(41.394)	(158.259)	(379.808)	(1498)	

Standard deviations in parenthesis.

*The negative values for these countries are due to large losses of single firms during the sample period.

The descriptive statistics in table 1 clearly show that our sample is not representative for multinational firms in the EU as a whole. This has to be kept in mind when interpreting the results in the following sections.

3. Benchmark case: Separate accounting with national loss-offset

The first step in our analysis is to consider the size and the distribution of the tax base under separate accounting (SA). This will serve as a point of reference when analysing an EU tax base with an FA system. We estimate the tax base by calculating the taxable profit for each firm in each country in the EU and assume that all countries use SA when taxing the corporate income of these firms. This also implies that there is no international loss-offset system in place. The taxable profits are then aggregated for each country. This yields what we call the national tax bases.

The benchmark case with SA can be illustrated using the following example. A German company owns two firms A and B in France. While firm A earns a profit of 100 Euro, firm B has a loss of 50 Euro. Since the two firms in France are in one group, we assume that they are able to consolidate their profits and losses inside France. The tax base in France is therefore 100 - 50 = 50 Euro. All profits of German owned firms in France are summed up after this national loss-offset regime.[25] This gives us the tax base in France for the case of SA.

We calculate the tax base for each EU15 country in every year from 1996 to 2001 in this way. This tax base contains only the corporate income of German FDI in the respective country using an SA approach. We refer to these tax bases as the distribution of tax bases across member countries under the current system of SA. Table 2 shows the sum of the tax base for each country for the years 1996 to 2001.[26]

Generally, large countries tend to have larger tax bases in our sample than small countries. But there are important exceptions. The Netherlands, Austria, Belgium and Sweden have large tax bases, too. This is a sample effect since the number of observations varies among countries and years. Therefore the absolute tax base is larger in countries with many observations. The highest number of observations is available

[25] There are different national loss-offset regimes in the EU member states. Assuming perfect loss-offset across firms of one group within member countries therefore is a simplification.
[26] The yearly tax bases are given in the appendix.

for Germany. Also, as noted in Section 2 the size of the headquarters compared to foreign subsidiaries is large and ties profits to Germany. This is the reason why the German tax base is by far the largest in the sample. Note that the information revealed by this distribution of absolute values of tax bases is limited because it reflects the specific properties of our data sample, i.e. the different numbers of observations. The values in table 2 serve as the starting point to compare the tax base distribution under SA with the pattern emerging under FA.

Table 2: The sum of the SA tax base for the EU15 countries in m. Euro for the years 1996-2001

Country	SA Tax Base
Austria	6.144
Belgium	7.659
Denmark	972
Finland	676
France	16.056
Germany	114.700
Great Britain	8.549
Greece	379
Ireland	1.314
Italy	6.634
Luxemburg	1.363
Netherlands	21.460
Portugal	1.923
Spain	6.897
Sweden	4.691

4. A European tax base

The idea of an EU tax base is to consolidate all European activities of a MNC according to a common set of accounting and tax rules.[27] Such a system also implies an EU wide loss-offset. We calculate such an EU tax base using the profits and losses of German parent companies and their subsidiaries in Europe. For purposes of illustration, assume that a German company has subsidiaries in Spain and Italy. The Spanish subsidiaries earn a consolidated profit of 100 Euro; the Italian firms make losses of 50 Euro. The profit of the German parent company is 50 Euro. A common European tax base would allow an international loss-offset in this scenario. We then have 50 - 50 + 100 = 100 Euro as the European tax base. The MNC's tax base is then apportioned to the countries where the multinational firm is active according to indicators like the amount of property in a country or the sales and payroll in a country.[28] This calculation is made for every single firm in the sample.

This approach to calculating a common European tax base is of course based on strong simplifications compared to the complex questions that arise when actually introducing the jurisdictional framework for the creation of an EU tax base. Firstly, group consolidation is more than just adding profits and losses for tax purposes.[29] Secondly, the EU member countries must agree on accounting standards used to calculate profits. Thirdly, there must be agreement on the definition and the measurement of the factors in the apportionment formula.[30] In so far, our approach of just adding profits and losses is rather crude. But it nevertheless allows to gain a first impression of the effects to be expected if SA is replaced by FA.

5. The choice of apportionment factors

The introduction of an EU tax base raises the question of how the tax base should be divided between the EU member countries. Debates on formula apportionment usually refer to three countries which use this system to allocate tax bases to subnational

[27] For a detailed review of the different tax base proposals see Devereux (2004). For an analysis of the efficiency impacts of the Home State Taxation versus the Common Consolidated Tax Base approach see Mintz and Weiner (2003).
[28] These are the usual apportionment factors as used in Canada and the US.
[29] For instance, the tax consequences of intra group sales of assets under full consolidation may be different from the consequences under pure profit and loss-offset.
[30] See e.g. Sorensen (2004).

jurisdictions. These countries are the USA, Canada and Switzerland.[31] The U.S. and the Canadian Systems differ strongly in the method of profit allocation. In the following, we briefly present the U.S. and the Canadian systems[32] and then present the formula used in our calculations which is a combination of the two systems.

The tax liability T_i of a company in a U.S. state i is given by the following equation

$$T_i = t_i \left[\alpha_i^P \frac{P_i}{P} + \alpha_i^L \frac{L_i}{L} + \alpha_i^S \frac{S_i}{S} \right] \pi_i$$

The U.S. states have the right to choose the tax rate t_i and the weights α_i^j for each apportionment factor *j*, where P stands for the total property of the firm in the U.S., L for the total payroll, and S for the total sales. The states may also modify the federal tax base, so that the tax base in state i is π_i. Many states use an evenly weighted three-factor formula where $\alpha_j^i = \frac{1}{3}$. This formula is not binding, though. The fact that U.S. states are allowed to change the weights α_i^j of each apportionment factor may easily lead to double taxation.[33]

The Canadian system grants less discretion to the provinces. The regional governments use the same tax base Π as the federal government and set the local tax rate. In addition, they may give tax credits or incentives to encourage private investment. The tax liability in this system is given by

$$T_i = t_i \left[\frac{1}{2} \frac{L_i}{L} + \frac{1}{2} \frac{S_i}{S} \right] \Pi ,$$

i.e. there are only the two factors payroll and sales entering the formula.

Note that, as pointed out by McLure (1980), a formula apportionment system has similar economic effects as a system imposing a tax on each single factor in the formula. In the case of the Canadian formula, it may be considered strange that a tax

[31] For a detailed description of the systems in these countries see Daly and Weiner (1993).
[32] For reasons of space, we do not describe the Swiss system which is rather complex because the formula used is different for different industries.
[33] See Goolsbee and Maydew (2000) for a detailed analysis of the change of apportionment weights in the U.S.

which supposedly taxes capital income uses only labor and sales in the formula. The reason for this choice of factors is that they are meant as a distribution device to allocate the tax base according to the economic activity of a company in one country. But it is not clear why factors which are more closely related to capital income like, for instance, property, are not included in the formula.

In our analysis we will use a three-factor formula to apportion the tax base to the EU countries. We will use a weight of $\frac{1}{3}$ on each of the factors, i.e. $\alpha_j^i = \frac{1}{3}$. Since our data contains no payroll information for German subsidiaries we apportion income according to the factors sales, property and employees.[34]

Accordingly, the tax liability of a German MNC in country i is

$$T_i = t_i \frac{1}{3}\left[\frac{P_i}{P} + \frac{S_i}{S} + \frac{E_i}{E}\right]\Pi$$

where P is the total property of the MNC in the EU15, S the total sales of the MNC, E the number of employees, and Π the taxable profit of the firm. The goal of our analysis is to estimate the tax base of the MNC in each country after Formula Apportionment. We calculate the tax base for every single MNC and sum up the firm-level tax bases to gain information on the national tax bases each country receives.

Figure 2 shows the mean of the apportionment factors for Germany for the years 1996 to 2001 in our sample. Germany has the largest shares of the factors compared to all other European countries. The reason is again that domestic activity of German firms is much larger than economic activity of their European affiliates. The factors range between 61 and 78 percent for Germany.

The comparison of apportionment factors for the year 1999 in the other countries (see Figure 3) shows that big countries like France and Great Britain have much higher shares in property and sales than the remaining countries.[35] Moreover, some smaller countries which are geographically close to Germany (Austria, Belgium, and Netherlands) attain almost the same factor shares as countries like Italy and Spain.

[34] Since the data does provide the number of employees of a subsidiary we can use this value as a proxy for payroll.

Figure 2: Germany's share in European property, sales and employees of German multinational companies.

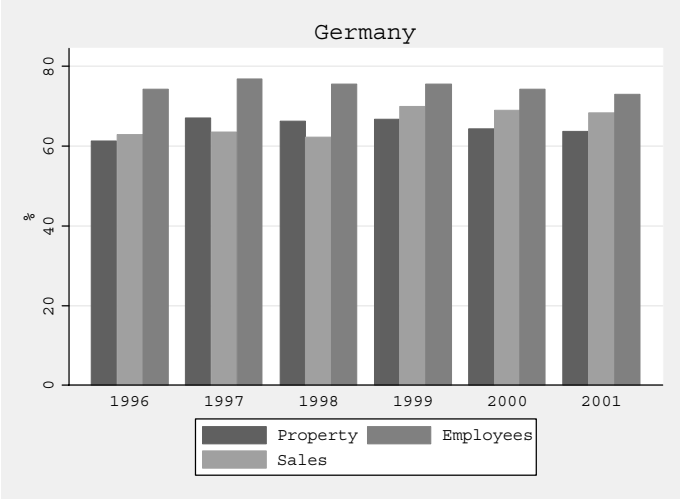
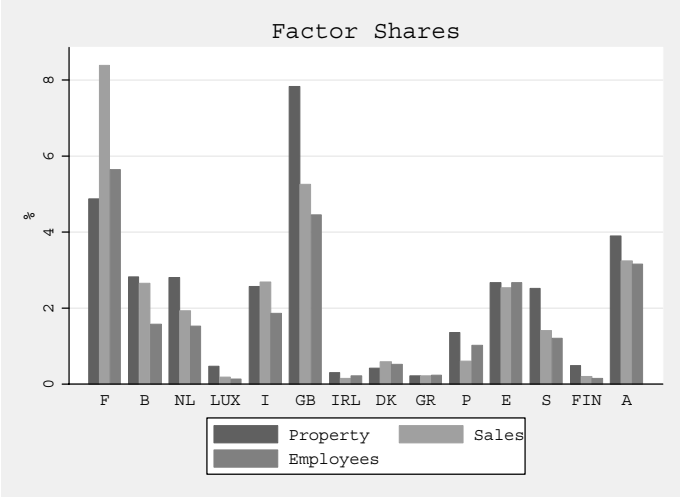


Figure 3: Country shares in European property, sales and employees of German multinational companies in 1999.



6. Comparison of tax bases

After defining the consolidated tax base and the apportionment factors we calculate the share of the tax base allocated to each country under FA. As noted in Section 3 the important information generated by this estimation is the difference in tax bases between FA and SA, rather than their absolute size. In the following analysis we

[35] The graphs with the shares for all years can be found in the appendix.

will distinguish between two effects of introducing a common EU tax base with FA. Firstly, a redistribution of tax base arises because a given overall tax base is now allocated according to indicators of economic activity instead of profits as measured by separate accounting. The second effect is due to the introduction of border crossing loss-offset. Most importantly, border crossing loss offset reduces the size of the EU-wide tax base. But it also changes the distribution of the tax base across countries. For instance, countries where firms are very profitable and suffer few losses will may lose a significant part of their tax base if domestic profits are set against foreign losses whereas countries where firms suffer high losses anyway will be affected less. As a first step, the next section focuses on the effect of introducing FA without EU-wide loss-offset.

6.1 Formula apportionment without border crossing loss-offset

This section considers the introduction of formula apportionment without border crossing loss-offset.[36] The SA European tax base is calculated by adding up the SA tax bases in the EU15 countries for each firm. If a firm suffers losses in a country, these losses can be carried forward in the country but cannot be set against profits from other countries. Thus, effectively, only profits are added. For each firm, EU wide profits are then distributed across countries according to the apportionment formula discussed above. Consider again the simple example introduced in section 4 of a German parent company with subsidiaries in Italy and Spain. German profits are 50, profits in Spain are 100 and the Italian subsidiary makes losses of 50. We would now sum up profits and ignore losses of the Italian subsidiaries, so that EU wide taxable profits are 150. This tax base is allocated to Italy, Spain and Germany according to the apportionment formula.

The results of this experiment are shown in table 3. The table also replicates the results of the SA case for comparison. It turns out that there are strong shifts in the national tax bases after apportionment. Six countries lose in this scenario: Belgium, the Netherlands, Ireland, Luxemburg, Finland, and Sweden.[37] On the other hand, some

[36] An introduction of formula apportionment without loss-offset would also be possible, though the discussion in Europe is mainly about FA with loss-offset. Hellerstein (2005) shows that the two elements can exist independently.

[37] The change in national tax bases change varies over the years. This shows that our data is volatile with respect to the national tax bases. The complete graphs of the national tax base shares for the different scenarios can be found in the appendix.

countries in Southern Europe like Portugal and Greece win tax base, as does Austria, which gains significantly.[38]

Among the large countries, all receive a larger tax base (Great Britain, Germany, and Spain) or obtain at least more or less the same tax base as in the SA case (France, Italy).

Thus, a pattern emerges where smaller countries and especially countries known for offering attractive tax regimes to MNC tend to lose tax base when firm profits are allocated according to the apportionment factors discussed above. These results could be interpreted as a hint that a significant amount of income shifting is going on under the current SA tax system. Note that the Netherlands, Belgium and Ireland lose a particularly large part of their tax base. These countries had tax regimes during the sample period that offered significant tax incentives to MNCs. While Ireland had a split corporate tax rate with a 10 percent rate on foreign manufacturing companies and special tax regimes like the "Dublin Docks", the Netherlands had attractive tax rules for holding companies and Belgium offered tax incentives for so called co-ordination centres of MNC.[39] These regimes can be used by companies to shift book profits in order to reduce their tax burden. It is plausible that the countries attracting these book profits under the SA system lose when indicators of economic activity are used for the allocation of the tax base.[40] Of course, low corporate tax rates as e.g. in Ireland will not only attract book profits but also real economic activity. But this effect should be reflected in increasing property, employment and sales of subsidiaries in Ireland. It cannot explain a loss in tax base caused by a switch from SA to FA.

[38] The high values for Austria are mainly due to observations in 2001. For the other years the change is still positive but much smaller. The results for Portugal and Greece are based on relatively few observations.

[39] The Belgium co-ordination, distribution and service centres, the Luxembourg co-ordination centres, Ireland split tax rate and the incentives for holding companies in the Netherlands are also mentioned and explained in the EU Code of Conduct on business taxation (1998). Sweden which also loses significantly is mentioned there with a special tax regime for insurance companies.

[40] It should be noted that it is difficult to find empirical evidence for transfer pricing activities since firms obviously try to hide such activities since tax administrations would otherwise enforce taxation and fine companies. Nevertheless, recent research as surveyed by Desai, Foley and Hines (2003) supports the view that companies use profit shifting measures like transfer pricing and thin capitalization in order to avoid taxation in high tax jurisdictions. Our results might therefore be interpreted as another hint for profit shifting.

Table 3: Comparison between the sum of the SA and an FA tax base without international loss-offset for the EU15 countries in m. Euro for the years 1996-2001

Country	SA Tax Base	Formula Apportionment without Loss-offset	Difference	Change in percent
Austria	6.144	16.793	10.649	173%
Belgium	7.659	5.625	-2.034	-27%
Denmark	972	1.047	75.309	8%
Finland	676	635	-41	-6%
France	16.056	16.129	73	0%
Germany	114.700	121.400	6.714	6%
Great Britain	8.549	13.168	4.619	54%
Greece	379	527	148	39%
Ireland	1.314	793	-521	-40%
Italy	6.634	6.748	114	2%
Luxembourg	1.363	1.114	-249	-18%
Netherlands	21.460	7.543	-13.916	-65%
Portugal	1.923	2.666	744	39%
Spain	6.897	7.273	377	5%
Sweden	4.691	3.053	-1.639	-35%

6.2 Formula Apportionment and international loss-offset

If we add the possibility of border crossing loss-offset, the overall tax base declines. Table 4 shows the values for the 15 countries and for the total EU tax base.

The first result is that now most countries lose part of their tax base compared to the benchmark case with SA. The reason is that many foreign subsidiaries of German firms in EU member states suffered losses in the period between 1996 and 2001 which are now set against profits of other subsidiaries or the parent company.[41] This acts as a tax relief for the MNC, given that tax rates remain unchanged. As a result, all countries lose tax base except for Austria, Greece, and Portugal. When considering the countries

where the introduction of an FA system reduces the tax base very strongly we again find that these are the countries with special tax regimes identified above: Netherlands (-74%), Sweden (-57%), Ireland (-51%), and Belgium (-41%). Under SA, these countries receive a share in the overall tax base which is high, relative to real economic activity as measured by the apportionment factors property, sales and employees. When a loss-offset system is introduced these countries lose even more than the results in section 6.1 suggested since the total allocable tax base is now smaller.

Table 4: Comparison of the sum of the SA tax base and the FA tax base for the years 1996-2001 in m. Euro.

Country	SA Tax Base	FA Tax Base	Difference	Change in percent
Austria	6.144	13.005	6.861	112%
Belgium	7.659	4.550	-3.109	-41%
Denmark	972	737	-235	-24%
Finland	676	509	-167	-25%
France	16.056	11.011	-5.045	-31%
Germany	114.700	95.351	-19.313	-17%
Great Britain	8.549	7.869	-680	-8%
Greece	379	435	56	15%
Ireland	1.314	650	-664	-51%
Italy	6.634	4.882	-1.752	-26%
Luxemburg	1.363	829	-534	-39%
Netherlands	21.460	5.481	-15.979	-74%
Portugal	1.923	2.165	242	13%
Spain	6.897	5.777	-1.120	-16%
Sweden	4.691	2.004	-2.685	-57%
EU15	**199.400.000**	**155.300.000**	**-44.100.000**	**-22%**

[41] See Fuest, Hemmelgarn and Ramb (2005) for an analysis of losses and profits of German FDI in Europe. Ramb and Weichenrieder (2004) also find that German subsidiaries had significant losses in this period.

Under an FA system, Germany still receives a large part of the tax base in the sample, but the European losses of the foreign subsidiaries reduce the German tax base considerably. Perhaps surprisingly, the decline in tax base for Germany (17%) is smaller than the decline in the EU-wide tax base, which is 22%. This pattern should not be overemphasized, though, because we only have information on German MNCs. It is likely that this biases the findings in particular for the German tax base. Table 5 shows the loss in the overall tax base due to border crossing loss-offset for each year in the sample. The decrease in the EU wide tax base fluctuates considerably. It is plausible that additional loss-offset possibilities have a particularly strong impact in boom years like 2000, where many firms make profits and EU wide losses and loss carryforwards can be used extensively.

Table 5: Comparison of the sums of the EU wide SA tax base and the EU wide FA tax base for the years 1996-2001 in b. Euro.

Year	EU wide SA Tax Base	EU wide FA Tax Base	Difference	Change in percent
1996	16,12	13,02	-3,09	-19%
1997	23,35	18,28	-5,08	-22%
1998	24,43	19,75	-4,68	-19%
1999	35,07	28,16	-6,91	-20%
2000	52,60	34,90	-17,70	-34%
2001	47,81	41,14	-6,67	-14%
Sum	**199,4**	**155,3**	**-44,1**	**-22%**

7. Conclusion

What effects would the introduction of a common tax base with formula apportionment have? The calculations in this paper lead to two main results. Firstly, if an FA system without loss-offset is introduced, small countries and in particular low tax countries or countries with special tax incentives for MNCs, which are commonly thought to attract book profits under the current system, would lose tax base. This happens because, under the current SA system, these countries attract a share of the EU wide tax base which is higher than their share in real economic activity as measured by

indicators like property, sales or payroll. On the other hand, larger countries tend to increase the share in the common tax base in an FA system without loss-offset. This reflects that, under the current system, the share of larger countries in the common tax base is small, relative to their share in economic activity. Since corporate taxes in these countries are high compared to the EU average, these results are consistent with the view that profit shifting takes place under the current tax system.

The second key result is that if a border crossing loss-offset is added to the FA system there is a significant effect on the overall size of the common European corporate tax base. The introduction of an EU tax base with loss-offset would imply that the overall tax base and most national tax bases decrease. According to our calculations, the overall tax base declines by approximately 20 percent. If we assume that countries do not alter their tax rates this change is the same for the tax revenue.

Both findings – the redistribution of tax base across countries and the decline in the overall tax base – suggest that the introduction of a common EU tax base with formula apportioning faces formidable political and economic challenges.

All these results, though, should be evaluated in the light of the limitations of the data used in this study. Our analysis is based on the data of German outward FDI in the EU15 and the respective German parent companies only. It is unclear to which extent our findings can be generalized. Furthermore, we do not consider behavioural changes that might take place when introducing FA. Nevertheless, our calculations give a first idea of how countries' tax bases and, hence, tax revenues could be affected if an EU corporate tax base with FA became a reality. The advantage of using German data is that German companies have many subsidiaries all over Europe which makes the dataset an imperfect but nevertheless useful tool for the approximation of overall tax base effects. Another more technical insight of our analysis is that there is a need for a European database that allows forecasting the revenue effects of such fundamental tax changes in greater detail.

References

Becker, S. O., K. Ekholm, R. Jaeckle and M.-A. Muendler 2005. Location choice and employment decisions: A comparison of German and Swedish multinationals, CESifo Working Paper 1374.

Daly, M. and J. M. Weiner 1993. Corporate tax harmonization and competition in federal countries: some lessons for the European Community?, *National Tax Journal* XLVI (4): 441-462.

Desai, M. A., C. F. Foley and J. R. Hines Jr. 2003. Chains of Ownership, Regional Tax Competition, and Foreign Direct Investment. In H. Herrmann and R. Lipsey, eds. *Foreign Direct Investment in the Real and Financial Sector of Industrial Countries*. Springer. Berlin, Heidelberg, New York: 61-98.

Deutsche Bundesbank 1998. "The Methodological Basis of the Deutsche Bundesbank's Corporate Balance Sheet Statistics," *Deutsche Bundesbank Monthly Report* 50 (October 1998), 49-64. Available Online: http://www.bundesbank.de/download/volkswirtschaft/mba/1998/199810mba_art03_bascorpbal.pdf

Devereux, M. P. 2004. Debating proposed reforms of the taxation of corporate income in the European Union, *International Tax and Public Finance* 11: 71-89.

European Commission 2004. European Tax Survey, Working paper 3. Taxation Papers.

ECOFIN 1998, The Code of Conduct on Business Taxation, available online at: http://europa.eu.int/comm/taxation_customs/resources/documents/primarolo_en.pdf

Fuest, C., T. Hemmelgarn and F. Ramb 2005. The tax revenue implications of Marks and Spencer for Germany, *Tax Notes International* 38(9): 763-767.

Fuest, C., Huber, B. and J. Mintz 2005. Capital Mobility and Tax Competition, *Foundations and Trends in Microeconomics* 1 (1):1-62.

Gérard, M., J. M. Weiner. 2003. Cross-Border Loss Offset and Formulary Apportioment: How do they affect Multijurisdictional Firm Investment Spending and Interjurisdictional Tax Competition?, CESifo Working Paper 1004.

Goolsbee, A. and E. L. Maydew 2000. Coveting thy neighbor's manufacturing: the dilemma of state income apportionment, *Journal of Public Economics* 75: 125-143.

Gordon, R. and J. D. Wilson 1986. An examination of multijurisdictional corporate income taxation under formula apportionment, *Econometrica* 54 (6): 1357-1373.

Hellerstein, W. 2005. The case for Fomulary Apportionment. *International Transfer Pricing Journal* 12 (3): 103-111.

Lipponer, A. 2003a. A "new" Micro Database for German FDI. In: H. Herrmann, and R. Lipsey, eds. *Foreign Direct Investment in the Real and Financial Sector of Industrial Countries*. Springer. Berlin, Heidelberg, New York: 215–244.

Lipponer, A. 2003b. Deutsche Bundesbank's FDI micro database, *Schmollers Jahrbuch – Zeitschrift für Wirtschafts- und Sozialwissenschaften*. (Journal of Applied Social Science Studies) 123: 593-600.

McLure, C. E. 1980. The State Corporate Income Tax: Lambs in Wolves' Clothing. In: H. J. Aaron, and M. J. Boskin, eds. The Economics of Taxation. Brookings Institution. Wahsington D.C.:327-346.

Mintz, J. 1999. Globalization of the corporate income tax: the role af allocation, *Finanzarchiv* 56(3- 4): 38-423.

Mintz, J. 2004. Corporate tax harmonization in Europe: it's all about compliance, *International Tax and Public Finance* 11: 221-234.

Mintz, J. and J. M. Weiner 2003. Exploring formula allocation for the European Union, *International Tax and Public Finance* 10: 695-711.

Mooij de, R. A. and S. Ederveen. 2003. "Taxation and Foreign Direct Investment: A Synthesis of Empirical Research," *International Tax and Public Finance* 10: 673-693.

Persoff, M. 2004. The impact of EU developments on member states' tax systems, *International Tax Review* 15(2): 10-14.

Pethig, R. and A. Wagener 2003. Profit Tax Competition and Formula Apportionment, CESifo Working Paper No. 1011.

Riedel, N. and M. Runkel 2005. Company tax reform with a water's edge, Working paper, University of Munich, Department of Economics.

Shackelford, D. and J. Slemrod 1998. The revenue consequences of using formula apportionment to calculate U.S. and foreign-source income: a firm-level analysis, *International Tax and Public Finance* 5: 41-59.

Sorensen, P. B. 2004. Company tax reform in the European Union, *International Tax and Public Finance* 11: 91-115.

Stoess, Elmar 2001. "Deutsche Bundesbank's Corporate Balance Sheet Statistics and Areas of Application," Schmollers Jahrbuch: Zeitschrift fuer Wirtschafts- und Sozialwissenschaften (Journal of Applied Social Science Studies) 121: 131-137.

Weichenrieder, A. J. 2005. What determines the use of holding companies and ownership chains? Unpublished Working paper.

Weichenrieder, A. and F. Ramb 2004. Taxes and the Financial Structure of German Inward FDI, CESifo Working Paper No. 1355.

Weiner, J. M. 1999. Using the experience in the U.S. States to evaluate issues in implementing formula apportionment at the international level, Office of Tax Analysis, Paper 83.

Wellisch, D. (2004). Taxation under Formula Apportionment - Tax Competition, Tax Incidence, and the Choice of Apportionment Factors, *FinanzArchiv*, 60 (1): 24-41.

Appendix: Data description

FDI data

The Deutsche Bundesbank carries out annual full sample surveys on inbound and outbound direct investment stocks based on the provisions of the German Foreign Trade and Payments Regulation. Due to this legal regulation, foreign companies with investments in Germany have to report balance sheet information of their German subsidiaries. The balance sheet data are calculated using the German accounting regulations. Similarly, German multinational companies have to report the same information about their foreign affiliates. The data is available for the years 1989 to 2003.

Time series for individual companies are available for the years 1996 to 2003. In 2002, about 6.000 domestic investors filed reports on around 22.000 foreign subsidiaries abroad. With respect to inward FDI, in 2002 data are available for about 10.000 affiliates in Germany, in which some 7.000 foreign investors had a participating interest. For a detailed description of the FDI database (MiDi), see Lipponer (2003a) and Lipponer (2003b).

In order to calculate an international loss-offset regime, we only use data from 1996 on. The panel dataset contains 1.844 German parent companies and 5.761 foreign subsidiaries in the EU15. This is of course a rather small amount of firms which also creates problems. This makes the data sensitive to small changes in the estimation setting. Nevertheless, the result that a decline in the EU tax base of around 20 percent occurs and that smaller countries tend to lose when FA is introduced are robust to different settings. For example we reduced the number of apportionment factors to sales and property where results did not change significantly.

The subsidiaries are based in the following EU15 countries: France (F), Belgium (B), Netherlands (NL), Luxembourg (LUX), Italy (I), Great Britain (GB), Ireland (IRL), Denmark (DK), Spain (E), Sweden (S), Finland (FIN), and Austria (A). 75 Percent of all subsidiaries are wholly owned by the German parent company and 90 percent are owned with a share higher than 51 percent. The mean of the parent's share in the foreign subsidiary is 91 percent. We therefore assume for simplicity that the subsidiaries are all fully owned, since we have no information on other non-German shareholders.

The most important branches of activity of the parent companies in our data set are Manufacturing, Holdings, Wholesale and Services to Companies. We concentrate on incorporated non-public companies that have either the legal form of a corporation or a limited liability company. Note that the fact that we observe holdings as an important form of German parent companies probably leads to an underestimation of the factor shares in Germany. The reason is that we cannot observe German subsidiaries of the German parent companies which would of course be part of the group. We therefore underestimate the tax base Germany receives in an FA system slightly.

German firm data

We use two datasets which we combine with the MiDi. The Ustan (Deutsche Bundesbank's Corporate Balance Sheet Statistics) is available from 1989 to 2001 while the Hoppenstedt database is available from 1996 to 2004. While Ustan contains tax and commercial balance sheet data, Hoppenstedt only covers commercial balance sheets of German corporations. Unfortunately, the data collection of Deutsche Bundesbank for the Ustan ends in 2001 which leads to a sharp drop in the number of German parent companies for the years 2002 to 2003. We therefore report only the results for the years 1996 to 2001. A detailed description of Ustan is provided by Stoess (2001). We have information on the tax balance sheets for 50 percent of the parent companies.

Matching the data

In order to combine our dataset we use a matching procedure that adds to every foreign subsidiary a German parent company if an identification variable is available. If the parent is found in Ustan and Hoppenstedt we choose the Ustan data since it contains also tax balance sheets which are more appropriate for our research which aims at estimating tax bases on the firm level.

The information on the number of employees is not mandatory for the subsidiaries. We therefore have to deal with missing data for this variable. We solve this problem by using two steps. Firstly, if a firm reports employees in some years but not in all we replace the missing by the mean of the number of employees for this year. Secondly, if we have no observations at all we run a simple regression where employment is the dependent variable and sales and property the explaining variables. This regression is

used to estimate the employment data for firms without any information on employment. We do this in order to maximize the number of observations which would other wise be reduced significantly. In order to check for robustness we also used a two factor formula where only sales and property are used as apportionment factors. This did not change the results of our analysis.

One important difference in the German data and the FDI data is the definitions of profit. While the data on German parent companies provides the pre-tax profits we only have information on the after tax profits of the foreign subsidiaries. We try to deal with this problem by using the statutory corporate tax rate of the host country and use it as multiplier in order to estimate roughly the pre-tax profit of companies. The calculation is simply

$$p^{pre-tax} = (1-t)\, p$$

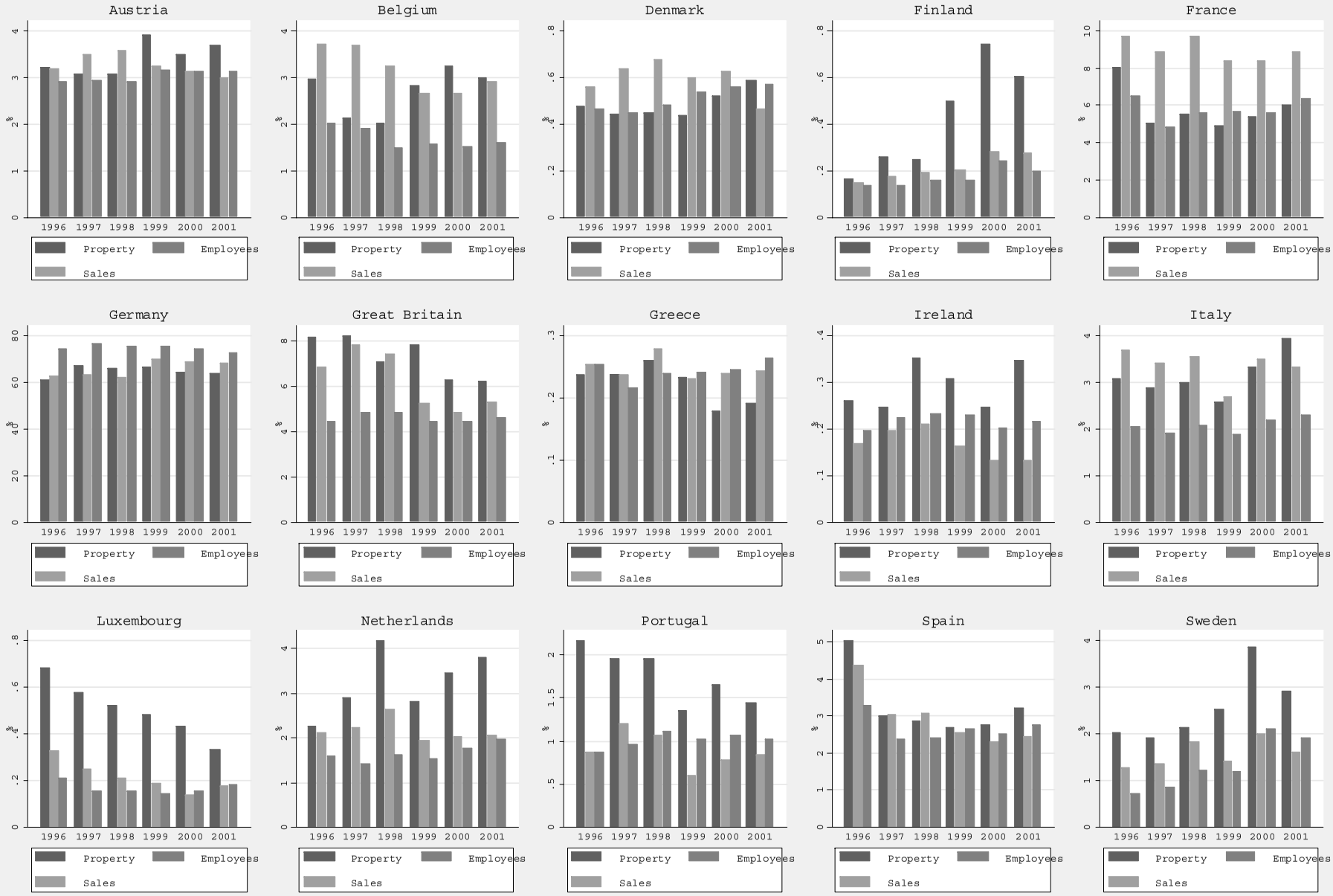
$$p = \frac{p^{pre-tax}}{(1-t)}$$

where t is the statutory tax rate and p is profit.

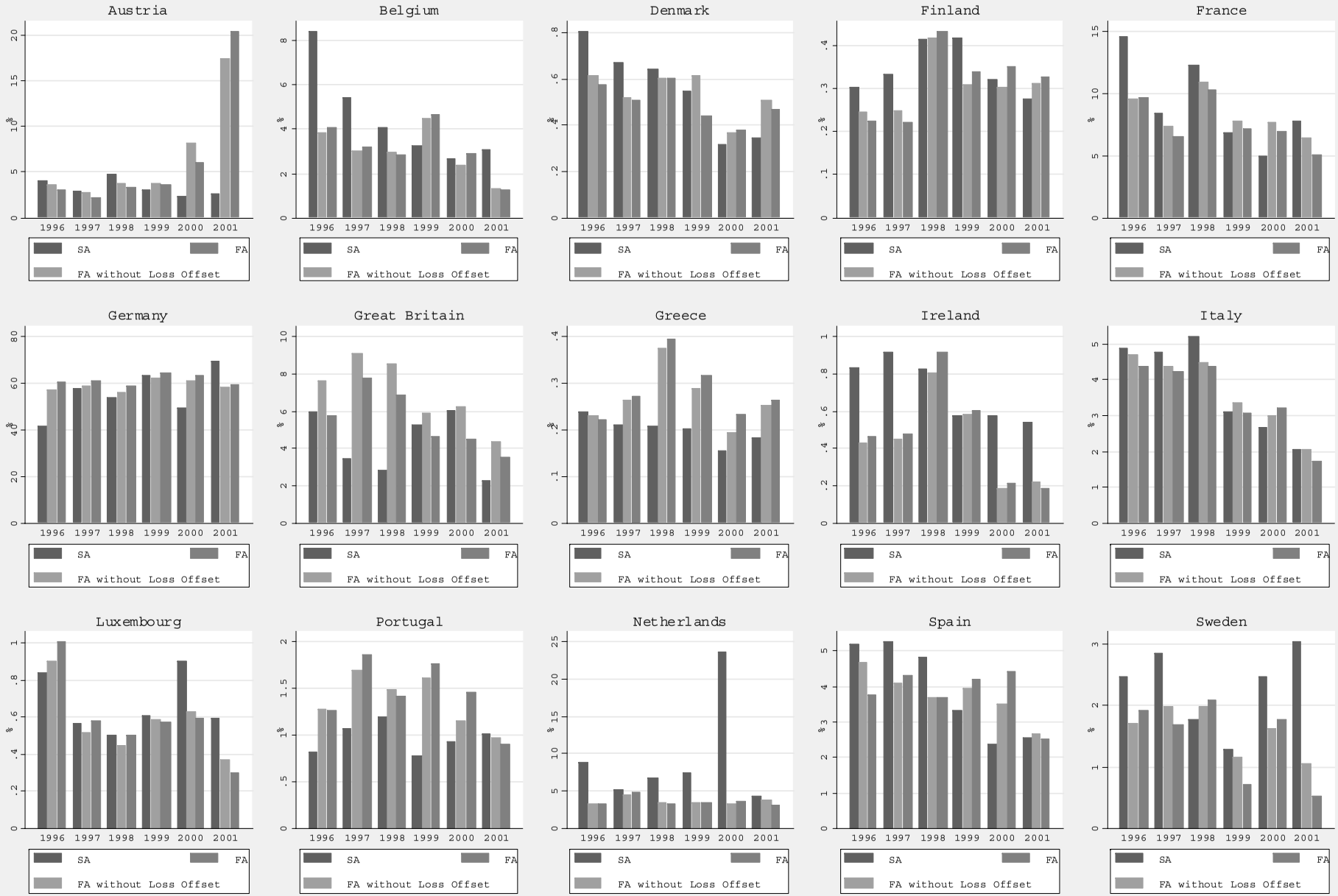
Yearly data for all countries

On the two pages we added the yearly shares of the countries in the apportionment factors and the share in the tax base each country receives. The first figure shows the factors. The second figure shows the tax base shares each country receives. We aggregated the national SA and FA tax bases and calculated the share each country receives. The first column is the share in the SA tax base, the second the share in the FA tax base without loss-offset while the last column shows the share in the tax base for the FA case with formula apportionment.

Country Shares in Property, Sales and Employees



Tax Base Shares



The following Discussion Papers have been published since 2005:

Series 1: Economic Studies

1	2005	Financial constraints and capacity adjustment in the United Kingdom – Evidence from a large panel of survey data	Ulf von Kalckreuth Emma Murphy
2	2005	Common stationary and non-stationary factors in the euro area analyzed in a large-scale factor model	Sandra Eickmeier
3	2005	Financial intermediaries, markets, and growth	F. Fecht, K. Huang, A. Martin
4	2005	The New Keynesian Phillips Curve in Europe: does it fit or does it fail?	Peter Tillmann
5	2005	Taxes and the financial structure of German inward FDI	Fred Ramb A. J. Weichenrieder
6	2005	International diversification at home and abroad	Fang Cai Francis E. Warnock
7	2005	Multinational enterprises, international trade, and productivity growth: Firm-level evidence from the United States	Wolfgang Keller Steven R. Yeaple
8	2005	Location choice and employment decisions: a comparison of German and Swedish multinationals	S. O. Becker, K. Ekholm, R. Jäckle, M.-A. Muendler
9	2005	Business cycles and FDI: evidence from German sectoral data	Claudia M. Buch Alexander Lipponer
10	2005	Multinational firms, exclusivity, and the degree of backward linkages	Ping Lin Kamal Saggi

11	2005	Firm-level evidence on international stock market comovement	Robin Brooks Marco Del Negro
12	2005	The determinants of intra-firm trade: in search for export-import magnification effects	Peter Egger Michael Pfaffermayr
13	2005	Foreign direct investment, spillovers and absorptive capacity: evidence from quantile regressions	Sourafel Girma Holger Görg
14	2005	Learning on the quick and cheap: gains from trade through imported expertise	James R. Markusen Thomas F. Rutherford
15	2005	Discriminatory auctions with seller discretion: evidence from German treasury auctions	Jörg Rocholl
16	2005	Consumption, wealth and business cycles: why is Germany different?	B. Hamburg, M. Hoffmann, J. Keller
17	2005	Tax incentives and the location of FDI: evidence from a panel of German multinationals	Thiess Buettner Martin Ruf
18	2005	Monetary Disequilibria and the Euro/Dollar Exchange Rate	Dieter Nautz Karsten Ruth
19	2005	Berechnung trendbereinigter Indikatoren für Deutschland mit Hilfe von Filterverfahren	Stefan Stamfort
20	2005	How synchronized are central and east European economies with the euro area? Evidence from a structural factor model	Sandra Eickmeier Jörg Breitung
21	2005	Asymptotic distribution of linear unbiased estimators in the presence of heavy-tailed stochastic regressors and residuals	J.-R. Kurz-Kim S.T. Rachev G. Samorodnitsky

22	2005	The Role of Contracting Schemes for the Welfare Costs of Nominal Rigidities over the Business Cycle	Matthias Paustian
23	2005	The cross-sectional dynamics of German business cycles: a bird's eye view	J. Döpke, M. Funke S. Holly, S. Weber
24	2005	Forecasting German GDP using alternative factor models based on large datasets	Christian Schumacher
25	2005	Time-dependent or state-dependent price setting? – micro-evidence from German metal-working industries –	Harald Stahl
26	2005	Money demand and macroeconomic uncertainty	Claus Greiber Wolfgang Lemke
27	2005	In search of distress risk	J. Y. Campbell, J. Hilscher, J. Szilagyi
28	2005	Recursive robust estimation and control without commitment	Lars Peter Hansen Thomas J. Sargent
29	2005	Asset pricing implications of Pareto optimality with private information	N. R. Kocherlakota Luigi Pistaferri
30	2005	Ultra high frequency volatility estimation with dependent microstructure noise	Y. Aït-Sahalia, P. A. Mykland, L. Zhang
31	2005	Umstellung der deutschen VGR auf Vorjahres-preisbasis – Konzept und Konsequenzen für die aktuelle Wirtschaftsanalyse sowie die ökono-metrische Modellierung	Karl-Heinz Tödter

32	2005	Determinants of current account developments in the central and east European EU member states – consequences for the enlargement of the euro erea	Sabine Herrmann Axel Jochem
33	2005	An estimated DSGE model for the German economy within the euro area	Ernest Pytlarczyk
34	2005	Rational inattention: a research agenda	Christopher A. Sims
35	2005	Monetary policy with model uncertainty: distribution forecast targeting	Lars E.O. Svensson Noah Williams
36	2005	Comparing the value revelance of R&D report-ing in Germany: standard and selection effects	Fred Ramb Markus Reitzig
37	2005	European inflation expectations dynamics	J. Döpke, J. Dovern U. Fritsche, J. Slacalek
38	2005	Dynamic factor models	Sandra Eickmeier Jörg Breitung
39	2005	Short-run and long-run comovement of GDP and some expenditure aggregates in Germany, France and Italy	Thomas A. Knetsch
40	2005	A“wreckers theory” of financial distress	Ulf von Kalckreuth
41	2005	Trade balances of the central and east European EU member states and the role of foreign direct investment	Sabine Herrmann Axel Jochem
42	2005	Unit roots and cointegration in panels	Jörg Breitung M. Hashem Pesaran
43	2005	Price setting in German manufacturing: new evidence from new survey data	Harald Stahl

1	2006	The dynamic relationship between the Euro overnight rate, the ECB's policy rate and the term spread	Dieter Nautz Christian J. Offermanns
2	2006	Sticky prices in the euro area: a summary of new micro evidence	Álvarez, Dhyne, Hoeberichts Kwapil, Le Bihan, Lünnemann Martins, Sabbatini, Stahl Vermeulen, Vilmunen
3	2006	Going multinational: What are the effects on home market performance?	Robert Jäckle
4	2006	Exports versus FDI in German manufacturing: firm performance and participation in inter-national markets	Jens Matthias Arnold Katrin Hussinger
5	2006	A disaggregated framework for the analysis of structural developments in public finances	Kremer, Braz, Brosens Langenus, Momigliano Spolander
6	2006	Bond pricing when the short term interest rate follows a threshold process	Wolfgang Lemke Theofanis Archontakis
7	2006	Has the impact of key determinants of German exports changed? Results from estimations of Germany's intra euro-area and extra euro-area exports	Kerstin Stahn
8	2006	The coordination channel of foreign exchange intervention: a nonlinear microstructural analysis	Stefan Reitz Mark P. Taylor
9	2006	Capital, labour and productivity: What role do they play in the potential GDP weakness of France, Germany and Italy?	Antonio Bassanetti Jörg Döpke, Roberto Torrini Roberta Zizza
10	2006	Real-time macroeconomic data and ex ante predictability of stock returns	J. Döpke, D. Hartmann C. Pierdzioch

11	2006	The role of real wage rigidity and labor market frictions for unemployment and inflation dynamics	Kai Christoffel Tobias Linzert
12	2006	Forecasting the price of crude oil via convenience yield predictions	Thomas A. Knetsch
13	2006	Foreign direct investment in the enlarged EU: do taxes matter and to what extent?	Guntram B. Wolff
14	2006	Inflation and relative price variability in the euro area: evidence from a panel threshold model	Dieter Nautz Juliane Scharff
15	2006	Internalization and internationalization under competing real options	Jan Hendrik Fisch
16	2006	Consumer price adjustment under the microscope: Germany in a period of low inflation	Johannes Hoffmann Jeong-Ryeol Kurz-Kim
17	2006	Identifying the role of labor markets for monetary policy in an estimated DSGE model	Kai Christoffel Keith Küster Tobias Linzert
18	2006	Do monetary indicators (still) predict euro area inflation?	Boris Hofmann
19	2006-	Fool the markets? Creative accounting, fiscal transparency and sovereign risk premia	Kerstin Bernoth Guntram B. Wolff
20	2006	How would formula apportionment in the EU affect the distribution and the size of the corporate tax base? An analysis based on German multinationals	Clemens Fuest Thomas Hemmelgarn Fred Ramb

Series 2: Banking and Financial Studies

1	2005	Measurement matters – Input price proxies and bank efficiency in Germany	Michael Koetter
2	2005	The supervisor's portfolio: the market price risk of German banks from 2001 to 2003 – Analysis and models for risk aggregation	Christoph Memmel Carsten Wehn
3	2005	Do banks diversify loan portfolios? A tentative answer based on individual bank loan portfolios	Andreas Kamp Andreas Pfingsten Daniel Porath
4	2005	Banks, markets, and efficiency	F. Fecht, A. Martin
5	2005	The forecast ability of risk-neutral densities of foreign exchange	Ben Craig Joachim Keller
6	2005	Cyclical implications of minimum capital requirements	Frank Heid
7	2005	Banks' regulatory capital buffer and the business cycle: evidence for German savings and cooperative banks	Stéphanie Stolz Michael Wedow
8	2005	German bank lending to industrial and non-industrial countries: driven by fundamentals or different treatment?	Thorsten Nestmann
9	2005	Accounting for distress in bank mergers	M. Koetter, J. Bos, F. Heid C. Kool, J. Kolari, D. Porath
10	2005	The eurosystem money market auctions: a banking perspective	Nikolaus Bartzsch Ben Craig, Falko Fecht
11	2005	Financial integration and systemic risk	Falko Fecht Hans Peter Grüner

12	2005	Evaluating the German bank merger wave	Michael Koetter
13	2005	Incorporating prediction and estimation risk in point-in-time credit portfolio models	A. Hamerle, M. Knapp, T. Liebig, N. Wildenauer
14	2005	Time series properties of a rating system based on financial ratios	U. Krüger, M. Stötzel, S. Trück
15	2005	Inefficient or just different? Effects of heterogeneity on bank efficiency scores	J. Bos, F. Heid, M. Koetter, J. Kolatri, C. Kool
01	2006	Forecasting stock market volatility with macroeconomic variables in real time	J. Döpke, D. Hartmann C. Pierdzioch
02	2006	Finance and growth in a bank-based economy: is it quantity or quality that matters?	Michael Koetter Michael Wedow
03	2006	Measuring business sector concentration by an infection model	Klaus Düllmann

Visiting researcher at the Deutsche Bundesbank

The Deutsche Bundesbank in Frankfurt is looking for a visiting researcher. Among others under certain conditions visiting researchers have access to a wide range of data in the Bundesbank. They include micro data on firms and banks not available in the public. Visitors should prepare a research project during their stay at the Bundesbank. Candidates must hold a Ph D and be engaged in the field of either macroeconomics and monetary economics, financial markets or international economics. Proposed research projects should be from these fields. The visiting term will be from 3 to 6 months. Salary is commensurate with experience.

Applicants are requested to send a CV, copies of recent papers, letters of reference and a proposal for a research project to:

Deutsche Bundesbank
Personalabteilung
Wilhelm-Epstein-Str. 14

D - 60431 Frankfurt
GERMANY