# The Laspeyres-Paradox: Tax Overshifting in Nineteenth Century Prussia

Spoerer, Mark

Humboldt University, Berlin

3 December 2007

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## Tax Overshifting in Nineteenth Century Prussia

*Mark Spoerer* *

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**Abstract** (126 words)

Following the seminal work of late nineteenth century economist Etienne Laspeyres we analyse the incidence of the Prussian milling and slaughter tax shortly before its repeal in 1875. A comparison of flour prices in cities which levied this tax with cities that did not reveals unusually strong tax overshifting. Modern theories explain overshifting of a specific tax with quality improvements or imperfect competition. In pursuing these ideas we find that it was rather large surplus costs induced by tax collection and monitoring that caused unusually large excess burdens. The reason why the tax remained nevertheless basically unchanged for more than half a century is that the urban bourgeoisie successfully prevented its repeal, as the alternative would have been the introduction of municipal direct taxes (rent-seeking behaviour).

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* School of Business and Economics, Humboldt University, Spandauer Str. 1, D-10178 Berlin, spoererm@wiwi.hu-berlin.de.

## I. Introduction

In November 1863, Ferdinand Lassalle, one of the founding fathers of the German Socialist Party, gave a public speech in which he criticized the Prussian tax system for its regressive distributional effects. Police arrested him right on the spot and he was charged of high treason. The public prosecutor justified his action with Lassalle's arguments on the incidence of indirect taxes which the prosecutor regarded as false and which he interpreted as sedition.

What did Lassalle say? Indirect taxes, he argued, lay especially heavy on the common people because the tax burden was fully shifted from the producers, who had to pay them formally, to their customers. As the Saxonian chief statistician Ernst Engel had showed a couple of years earlier, the propensity to consume was negatively correlated with income, so that the impact of indirect taxes, and above all the notorious Prussian milling and slaughter tax, was regressive. Most contemporary economists, though critical of Lassalle's political aims, agreed with his analysis, so that the case against Lassalle had to be abandoned. Today it is still commonly assumed that the burden of indirect taxes is shifted—this is precisely one of the reasons why they are called "indirect".

Despite its obvious importance for the assessment of tax and redistribution policies, the analysis of the economic burden of taxation is still an intricate issue in modern economics. On the theoretical side, there is a vast and very sophisticated literature that builds on Arnold Harberger's general equilibrium approach to incidence analysis.[1] Empirical economists, however, have found many obstacles to correctly measure the tax burden and mostly stick to the partial analysis approach which is still quite difficult to perform.[2] Economic historians have only very rarely and remotely touched the issue.[3] In 1978, a short debate evolved between Peter Mathias and Patrick O'Brien on the one hand and Donald McCloskey on the other. The former analysed the impact of taxation on economic growth in Britain and France and acted on the usual assumption that the burden of indirect taxes was fully shifted whereas that of direct taxes was not. This provoked McCloskey's comment who argued that the incidence should be measured rather than assumed. Mathias and O'Brien responded that there were no data to elaborate on this

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[1] Arnold C. Harberger (1962), "The Incidence of the Corporation Income Tax", *Journal of Political Economy*, 70, pp. 215-240. I would like to thank Jochen Streb for many helpful comments on earlier versions of this paper.

[2] See B.K. Atrostic and James R. Nunns (1990), "Measuring Tax Burden: A Historical Perspective", in Ernest R. Berndt and Jack E. Triplett (eds.), *Fifty Years of Economic Measurement: The Jubilee of the Conference on Research in Income and Wealth*, Chicago: University of Chicago Press, pp. 343-408; John Creedy (1998), *Measuring Welfare Changes and Tax Burdens*, Cheltenham: Elgar, chs. 7, 8 and 11; Don Fullerton and Gilbert E. Metcalf (2002), "Tax incidence", in Alan J. Auerbach and Martin Feldstein (eds.), *Handbook of Public Economics*, vol. IV, Amsterdam et al.: Elsevier, pp. 1787-1872, here pp. 1817-1823.

[3] We could not find a single study published in English or German that analyses tax incidence in a historical perspective. Jonathan B. Pritchett (1989), "The Burden of Negro Schooling: Tax Incidence and Racial

issue and that the "burden of proof" lay on McCloskey.[4]  Though Rolf Dumke and Eckart Schremmer soon joined McCloskey in pleaing for a historical analysis of tax incidence, the issue has not been taken up by economic historians so far.[5]

For a start, the incidence of the Prussian milling and slaughter tax is worth a closer look.  As this tax was much disputed in Prussia, there is a comparably large literature on it.  Moreover, it had a certain feature that is conducive to empirical analysis: it was levied just in a part of the Prussian cities, so that the other part may serve as a natural control group.

The milling and slaughter tax was introduced with the tax reform of 1820 when the Prussian state levied the so-called class tax (graduated tax) on taxpayers in the countryside and those in most small cities.  In most large cities the milling and slaughter tax, a specific (or excise, i.e., not *ad valorem*) tax, was levied instead.  While both taxes were state taxes, the cities were granted the right to add municipal surtaxes.

A decade after the Lassalle affair, the tax was repealed.  Having lost its political explosiveness, it found the interest of the freshly tenured German economist Etienne Laspeyres, descendant of a Huguenot family and today well-known to economists for his price index formula.  In 1877 and 1901, he published two articles in which he analysed the incidence of the Prussian milling and slaughter tax. Laspeyres was not so much interested in the tax itself but saw it as a useful example to analyze the incidence of tariffs on foodstuffs, an issue intensely debated among German economists and politicians at the time (Germany introduced protectionist tariffs in 1879).  The fact that the milling and slaughter tax had been levied only in a part of the Prussian cities allowed him to compare the prices of flour and meat in cities with the tax and in cities without (i.e., in which the class tax was levied instead).  His empirical results seemed paradoxical. In line with the prevailing economic thinking of the time he had expected that the burden of the tax would be shifted fully or nearly fully from the producers to the consumers, that is around 100 per cent or below.  Yet, whereas he found that this was indeed the case for the slaughter tax, the shifting of the milling tax was around 120 per cent in the case of wheat flour and around 200 per cent in the case of rye flour.

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Redistribution in Postbellum North Carolina", *Journal of Economic History*, 39, pp. 966-973, merely assumes a value for the incidence, like Mathias and O'Brien (see next footnote).

[4]  Peter Mathias and Patrick O'Brien (1976), "Taxation in Britain and France, 1715-1810. A Comparison of the Social and Economic Incidence of Taxes Collected for the Central Governments", *Journal of European Economic History*, 5, pp. 601-650; idem (1978), "The Incidence of Taxation and the Burden of Proof", *ibid.*, 7, pp. 211-213; Donald McCloskey (1978), "A Mismeasurement of the Incidence of Taxation in Britain and France, 1715-1810", *ibid.*, 7, pp. 209f.

[5]  See Rolf H. Dumke (1985), "Zum Problem der Nicht-Neutralität der Steuersysteme im Industrialisierungs-prozeß", in Hubert Kiesewetter and Rainer Fremdling (eds.), *Staat, Region und Industrialisierung*, Ostfildern: Scripta Mercaturae, pp. 67-71, here p. 67; Eckart Schremmer (1989), "Taxation and Public Finance: Britain, France, and

In his 1877 article, Laspeyres tried to explain why the prices of flour were much higher than one would expect.  His economic arguments, however, were not convincing, and in the 1901 article he restrained himself from any economic explanation.  In a way, the analysis he performed in the second article was what would be called a few decades later 'measurement without theory'.[6] His German colleagues mainly ignored his results or used them as an argument to show that it was anyway useless trying to determine tax incidence empirically.  Although Laspeyres' analysis is probably the earliest and certainly the most detailed early attempt to specify the incidence of a tax empirically, this piece of his oeuvre has fallen into oblivion.[7]

After World War II, discussions on the distributional effects of taxation raised interest in the incidence issue.  An increasing number of empirical studies found that certain specific taxes were shifted by more than 100 per cent.  Soon, the phenomenon was named overshifting.  We will discuss recent theoretical contributions to explain tax overshifting in the next section.  In the third section, we return to the Prussian milling and slaughter tax and check whether we can reproduce Laspeyres' empirical findings.  This will be the case and so we analyse in the fourth section whether modern approaches are able to explain Laspeyres' paradox.  Although it will turn out that they are not, in pursuing these ideas we will find evidence that enables us to argue that the observed overshifting in the flour market was a result of extraordinary high tax collection and monitoring costs that caused surplus costs for producers.  In the concluding section we will discuss why Prussia sticked for over half a century to a tax that weighed unusually heavy on producers, consumers and even the state.

## II. Tax Overshifting in Theory

It was only after World War II when economists took an interest in empirically analyzing tax incidence again.  Occasionally, these analyses produced findings similar to those of Laspeyres' three quarters of a century before.  Among them was, for example, William Niskanen who analysed the demand of alcoholic beverages.[8]

These results did not seem compatible with the theory at the time.  In general, the opportunity to shift the burden of a producer tax to the consumer depends on the elasticities of

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Germany", in *The Cambridge Economic History of Europe*, vol. VIII, Cambridge: Cambridge University Press, pp. 315-494, here p. 423.

[6]  Tjalling C. Koopmans (1947), "Measurement without Theory", *Review of Economic Statistics*, 29, pp. 161-172.

[7]  Even Edwin Seligman, who was strongly influenced by German public economists, did not discuss Laspeyres' articles on tax incidence, although he was aware of the (in Germany hardly ever quoted) 1877 article; Edwin Seligman (1910), *The Shifting and Incidence of Taxation*, 3rd edn., New York: Columbia University Press, p. 372.  In the second edition of 1899, there is no reference made to this part of Laspeyres' work, see p. 300.

[8]  William A. Niskanen (1963), *The Demand for Alcoholic Beverages*, Ph.D. diss. Chicago, pp. 54f.  See for an overview of early studies that found overshifting: James M. Poterba (1996), "Retail Price Reactions to Changes in State and Local Sales Taxes", *National Tax Journal*, 49, pp. 165-176.

demand and supply. In a partial analytic framework with a specific production tax the share of the tax burden borne by the consumers is

(1)    $dp / dt = \varepsilon / (\varepsilon - \eta)$ ,

where p denotes the price, t the tax rate, $\varepsilon$ the price elasticity of supply and $\eta$ the price elasticity of demand (usually, $\eta \leq 0$). Under the assumptions of a downward sloping demand curve, competitive markets and an upward sloping supply curve, the producers can shift only a part of the tax burden to the consumers. If demand is totally inelastic or, following Ricardo, the supply curve is flat, the producers can pass the whole burden on to the consumers. In this framework, the price without tax, $p^*$, rises to $p(t)$ after the tax is levied, and the following inequalities must hold:

(2)    $0 \leq \Delta p(t) = p(t) - p^* \leq t \quad \leftrightarrow \quad 0 \leq \Delta p(t)/t \leq 1$.

Hence, under the usual assumptions the shifting cannot exceed 100 per cent of the tax amount, and there is no room for overshifting in the partial analytic framework.[9]

The first theoretical explanation for overshifting was formulated by Yoram Barzel in 1976. He showed that levying a specific tax may lead to an increase of the taxed product's quality.[10] The intuition is that if a producer of, e.g., cigarettes has to pay a tax of 10 cents per cigarette regardless of its value, he will have an incentive to improve the quality of the tobacco or to produce longer cigarettes so that he can dilute the tax burden. Due to the better quality of his product, he may be able to increase the price by more than 10 cents. Barzel's explanation is regarded as the first explanation for overshifting. In our view, however, this is not quite the case as Barzel looked at two different products: one before taxation, and an improved one afterwards. Hence the *ceteris paribus* condition is violated. As we will see in the empirical part, however, Barzel's idea gives valuable insight in how nineteenth century producers reacted on a specific tax.

Further and more convincing explanations came up in the 1980s with the boom of the industrial organization literature that allowed for imperfect competition. In an unpublished but seminal and often quoted paper, Jesús Seade showed that in the case of oligopolistic competition a specific tax may lead to overshifting. The intuition behind his argument and others that followed soon is as follows. The imposition of the tax will typically increase costs and thus the price which leads to a reduction of demand and thus the equilibrium number of firms. This reduction leads to an increase of market power (i.e., the opportunity to sell above marginal costs)

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[9]  Timothy J. Besley and Harvey S. Rosen (1999), "Sales Tax and Prices: An Empirical Analysis", *National Tax Journal*, 52, pp. 157-178. Of course, the tax may also be shifted backwards to producers of input goods. The analysis is symmetric.

[10]  Yoram Barzel (1976), "An Alternative Approach to the Analysis of Taxation", *Journal of Political Economy*, 84, pp. 1177-1197.

for the remaining firms who will increase prices. If the price elasticity of demand is sufficiently inelastic, this price increase will exceed the tax amount, and overshifting will occur.[11] Empirical work on the US retail trade that makes use of precisely the same feature as found by Laspeyres, that is of the fact that different US cities levy different local sales tax rates, does indeed find overshifting, especially for non-durable consumer goods.[12] This strand of the literature also discovered that it has an eminent ancestor. As early as in 1838, it was Augustin Cournot who, discussing the effect of a specific tax on a monopoly product, had deduced formally that in this case the gross price of the product may increase by more than the tax amount.[13]

Another variation of this argument relies on a different set of assumptions. Timothy Besley has shown that in markets that are characterized by zero profits, positive fixed costs and free entry the imposition of a specific tax increases the unit costs of production. As a consequence, the gross price $p(t)$ is larger than the sum of the price before the imposition of the tax $p^*$ and the tax amount $t$, i.e. we find tax overshifting.[14] We will come back to this argument in the discussion of Figure 3 below.

### III. The Incidence of the Prussian Milling and Slaughter tax

In this section and the following, we address two questions. First, if we control for other factors that might affect Prussian flour and meat prices, are we able to reproduce Laspeyres' findings? Second, if so, are the approaches in the modern literature sufficient to explain what Laspeyres found paradoxical?

The Prussian milling and slaughter tax was introduced in 1820. The criteria on which the central government in Berlin decided whether a city should levy the milling and slaughter tax or the class tax were city size and, in respect to guarding the tax line, topographical characteristics. As a result the tax was levied only in part of the Prussian cities. In the other, often (but not always) small cities and rural areas, the Prussian state levied the class tax, which was a hybrid of a

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[11]  Jesús Seade (1985), "Profitable Cost Increases and the Shifting of Taxation: Equilibrium Responses of Markets in Oligopoly" (University of Warwick, Discussion Paper no. 260), Warwick. See also Nicholas H. Stern (1987), "The Effects of Taxation, Price Control and Government Contracts in Oligopoly and Monopolistic Competition", *Journal of Public Economics*, 32, pp. 133-158, here pp. 140f., 154; Sofia Delipalla and Michael Keen (1992), "The Comparison Between Ad Valorem and Specific Taxation Under Imperfect Competition", *Journal of Public Economics*, 49, pp. 351-368. For a different formulation of Seade's argument, see Fullerton and Metcalf (2002), pp. 1825f.
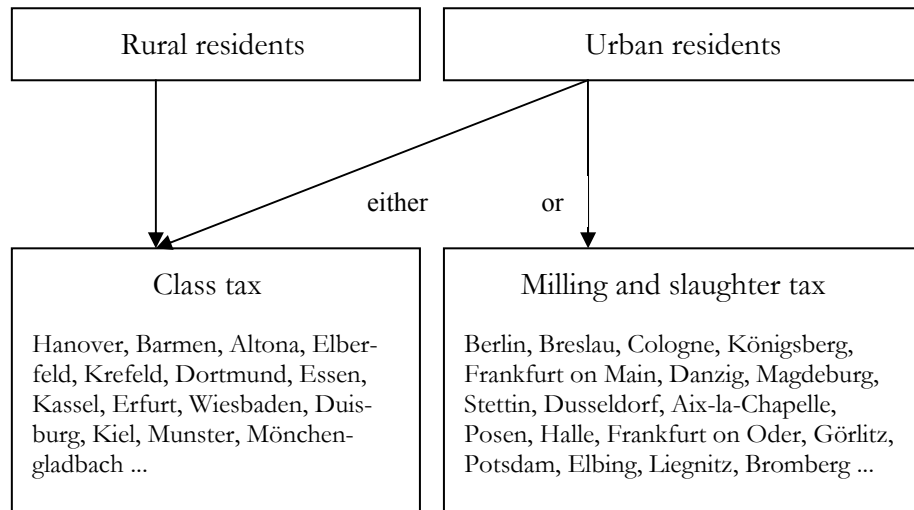
[12]  Besley and Rosen (1999).

[13]  Augustin Cournot (1838), *Recherches sur les principes mathématiques de la théorie des richesses*, Paris: Hachette, p. 77. This had already been assumed by Adam Smith, but without theoretical reasoning; Adam Smith (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations*, London: Strahan & Cadell, vol. II, pp. 484, 487. Cf. Delipalla and Keen (1992), p. 356.

[14]  Timothy J. Besley (1989), "Commodity Taxation and Imperfect Competition. A Note on the Effects of Entry", *Journal of Public Economics*, 40, pp. 359-367.

poll tax and a primitive income tax and is usually translated as 'graduated tax'.[15] The milling and slaughter tax was not introduced in the new northwest German territories Prussia acquired in 1866 (except Frankfurt on Main, where it was introduced to replace the municipal excise).

Figure 1: Who Paid the Class Tax and Who the Milling and Slaughter Tax in 1873?

| Rural residents | Urban residents |
|---|---|

either or

| Class tax | Milling and slaughter tax |
|---|---|
| Hanover, Barmen, Altona, Elberfeld, Krefeld, Dortmund, Essen, Kassel, Erfurt, Wiesbaden, Duisburg, Kiel, Munster, Mönchengladbach ... | Berlin, Breslau, Cologne, Königsberg, Frankfurt on Main, Danzig, Magdeburg, Stettin, Dusseldorf, Aix-la-Chapelle, Posen, Halle, Frankfurt on Oder, Görlitz, Potsdam, Elbing, Liegnitz, Bromberg ... |

Sources: Ludwig Herrfurth (1878), "Beiträge zur Statistik der Gemeindeabgaben in Preussen. Unter Benutzung amtlicher Quellen bearbeitet", *Zeitschrift des königlich preussischen statistischen Bureaus*, 18, pp. 1-60, here p. 26; Prussian cities sorted according to population in 1875 (> 30,000), see *Statistisches Jahrbuch für das Deutsche Reich*, 1 (1880). Ed. by Kaiserliches Statistisches Amt, Berlin: Puttkammer & Mühlbrecht, p. 7.

Both taxes, but especially the milling and slaughter tax, faced strong criticism. When contemporary economists discussed tax reforms in Prussia, many criticized the milling and slaughter tax for three reasons. First, it was obviously an unsystematic feature of the tax system to have the rural residents and part of the urban residents pay the (direct) class tax and the other part of the urban residents pay the (indirect) milling and slaughter tax. This divided the tax system between the countryside and most cities. Second, the milling and slaughter tax required a tax line that had to be drawn around the affected cities. Inside this line, which was guarded and thus caused costs, milling grain and slaughtering cattle was subject to permission and monitoring of the local tax authorities. Tax line and supervision hampered trade. An unwelcome though not surprising side-effect was smuggling, mainly of flour. Third, economists and practicians widely assumed that at least a part of the tax burden was shifted to the consumers via an increase of flour prices and thus of bread prices. After the publication of what became known as Engel's Law in 1857, the regressive consequences were obvious.[16] In addition, even in cities of

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[15]  Schremmer (1989), p. 424.

[16]  Ernst Engel (1857), "Die vorherrschenden Gewerbezweige in den Gerichtsämtern mit Beziehung auf die Productions- und Consumtionsverhältnisse des Königreichs Sachsen", *Zeitschrift des sächsischen Statistischen Bureaus*, 3, pp. 129-182, here pp. 169-172.

comparable size and wealth the milling and slaughter tax load per capita was about twice as high as the class tax load per capita.[17] These deficiencies evoked criticism at a time when the social question gained increasing attention.

As a consequence, the history of the milling and slaughter tax is full of attempts to reform or to repeal it. The protests peaked in the years of famine 1846-7 and in the 1860s, when the social question came on the political agenda—see the detention of Lassalle. Only when the Prussian state finances were in unusual good shape, partly thanks to the French war indemnity, was the tax repealed in 1873 (effective January 1, 1875).

Laspeyres devoted two articles to the subject. The first was published in 1877 in an Austrian statistical journal and was based on 13,440 monthly prices. For the second he had generations of students compute price averages from millions of monthly observations supplied by the Prussian Statistical Bureau. Finally, he published his second article 1901 in the renowned *Finanz-Archiv*.[18]

In neither article did Laspeyres perform a cross-section analysis by directly comparing the prices of cities that levied the milling and slaughter tax (henceforth "tax cities") with those that levied the class tax (henceforth "non-tax cities"). Instead he compared the difference of the price changes in the two groups of cities shortly before and after the repeal. The main difference between the two articles was that in the latter Laspeyres increased the number of observed products and cities.

His basic findings were nevertheless the same: full shifting or weak undershifting of the slaughter tax in the meat markets, weak overshifting of the milling tax in the wheat flour market and strong overshifting in the rye flour market. After the repeal of the tax, the price differences vanished immediately. We reproduce his main results in Table 1 (next page).

As Laspeyres used a larger sample and a slightly refined analysis in his 1901 article, we refer to the right part of Table 1 (cols. v to viii). Column (v) shows the absolute amount of the tax in *Pfennig* per kilogram, and column (vi) compares this to the average price in the tax cities. As we can see, wheat flour was taxed strongest relative to its value. In column (vii), Laspeyres compares the difference of the price changes between non-tax cities and tax cities in 1874 and 1875, when the tax became ineffective. In tax cities the changes of flour and meat prices were much stronger than in non-tax cities. The pork prices, e.g., were in line with the predictions of the theory as the average price decrease between 1874 and 1875 was 8.3 *Pfennig* larger in tax cities than in non-tax

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[17] *Deutsche Gemeinde-Zeitung*, 1 (1862), pp. 561, 573.

[18] Etienne Laspeyres (1877), "Statistische Untersuchungen über den Einfluss einer Steueraufhebung auf die Preise der bisher besteuerten Producte", *Statistische Monatschrift*, 3, pp. 497-514, 545-555; idem (1901), "Statist. Untersuchungen zur Frage der Steuerüberwälzung, geführt an der Geschichte der preussischen Mahl- und Schlachtsteuer. Nach gedruckten und ungedruckten Quellen", *Finanz-Archiv*, 18, pp. 46-282.

cities (prices generally fell in this period). This difference was slightly below the amount of the tax (9.0 *Pfennig*), which thus had been nearly fully shifted in 1874, more precisely by 92 per cent (col. viii = col. vii / col. v). The shifting of the tax on wheat flour was a bit outside the expected range (120 per cent > max [0.0; 1.0]) and could possibly be attributed to measurement error, but that of rye flour was disturbing. How could a tax of 1.67 *Pfennig* per kilogram of rye flour have caused a price difference of 3.1 *Pfennig* between tax cities and non-tax cities? Laspeyres performed an impressive series of sensitivity analyses in order to detect pseudo-correlations, but to no effect.

Table 1: Differences in Price Fluctuations in Prussian Cities After the Repeal of the Milling and Slaughter tax, 1874-75

| Article | 1877 (20 cities) | | | | 1901 (136 cities) | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | t | t / p | Δ p | - Δ p / t | t | t / p | Δ p | - Δ p / t |
| Year | 1874 | 1874 | 1874→75 | | 1874 | 1874 | 1874→75 | |
| Dimension | [Pf/kg] | [per cent] | [Pf/kg] | [per cent] | [Pf/kg] | [per cent] | [Pf/kg] | [per cent] |
| | (i) | (ii) | (iii) | (iv) | (v) | (vi) | (vii) | (viii) |
| Rye flour | 1.38 | 3.9 | -3.00 | 217 | 1.67 | 4.6 | -3.10 | 186 |
| Wheat flour | 5.48 | 11.3 | -6.90 | 126 | 6.67 | 12.7 | -8.00 | 120 |
| Pork | 10.28 | 7.7 | -10.28 | 100 | 9.00 | 6.8 | -8.30 | 92 |
| Beef | 10.28 | 9.3 | -9.90 | 96 | 9.00 | 7.4 | -7.30 | 81 |
| Potatoes | 0.00 | - | n/a | - | 0.00 | - | -0.30 | - |
| Butter | 0.00 | - | n/a | - | 0.00 | - | +0.10 | - |

Notes: kg – kilogram; n/a – not available; p – price in tax cities; Δp – difference of the price changes in non-tax cities vs. tax cities; Pf = *Pfennig* (100 *Pfennig* = 1 Mark); t – tax amount. As we recalculated Laspeyres' averages some figures deviate very slightly from his.

Sources: Etienne Laspeyres (1877), "Statistische Untersuchungen über den Einfluss einer Steueraufhebung auf die Preise der bisher besteuerten Producte", *Statistische Monatschrift*, 3, pp. 497-514, 545-555, here pp. 508-512, 546-550; idem (1901), "Statist. Untersuchungen zur Frage der Steuerüberwälzung, geführt an der Geschichte der preussischen Mahl- und Schlachtsteuer. Nach gedruckten und ungedruckten Quellen", *Finanz-Archiv*, 18, pp. 46-282, here pp. 232, 280.

Now, are we able to reproduce Laspeyres' results? We rely on the same data source for prices as he did. The Prussian Statistical Office published monthly prices of food and other necessaries since 1865 which, in 1873, covered 157 cities. Here we use the prices from July 1873 to June 1874 (and in an auxiliary calculation from July 1875 to June 1876). This allows a comparison with Laspeyres' figures which are from January 1874 to December 1875 and avoids noise in the data due to anticipatory effects (hardly anybody would have postponed meat consumption in July 1874 for six months). We also collected prices for rye and wheat, the main inputs for the flour production. Local cattle prices, however, were not recorded by the statistical office or other institutions. Table 2 (next page) summarizes the main descriptive characteristics of the price and tax data.

Table 2: Descriptive Statistics of the Price and Tax Data, July 1873 to June 1874 (*Pfennig* per kilogram)

| | Non-tax cities | | | Tax cities | | | |
| | Prices | | | Prices | | Taxes | |
| | mean (i) | SD (ii) | cities (iii) | mean (iv) | SD (v) | mean (vi) | cities (vii) |
|---|---|---|---|---|---|---|---|
| Rye flour | 35.06 | 4.56 | 91[a] | 38.23 | 4.80 | 1.94 | 63 |
| Rye | 21.32 | 1.25 | 88 | 20.56 | 1.42 | - | 59 |
| Wheat flour | 47.88 | 5.37 | 93[a] | 55.42 | 5.92 | 6.90 | 63 |
| Wheat | 27.20 | 1.39 | 85 | 26.17 | 1.62 | - | 58 |
| Pork | 132.96 | 13.28 | 93 | 133.68 | 12.74 | 8.95 | 63 |
| Beef | 134.56 | 20.78 | 94 | 131.26 | 17.44 | 8.95 | 63 |

Notes: SD – standard deviation. Wheat, rye, rye flour and pork price data are not available for all of the 157 cities.
[a] One outlier excluded.

Sources: *Zeitschrift des königlich statistischen preußischen Bureaus*, 13 (1873). Ed. by Königliches Statistisches Bureau, Berlin: Königliches Statistisches Bureau, pp. 181-256; *ibid.*, 14 (1874), pp. 45-80, 401-442 (prices); *Deutsche Gemeinde-Zeitung*, 6 (1867), p. 437; Emil Blenck (1871), "Beiträge zur preussischen Staats- und Communal-Finanzstatistik", *Zeitschrift des königlich preußischen statistischen Bureaus*, 11, pp. 145-162, here pp. 161f. (taxes).

If we compare the average tax amount (col. vi) with the difference of the price means between tax cities and non-tax cities (col. iv – col. i) we can reproduce what Laspeyres found paradoxical, i.e. strong overshifting of the tax in the rye flour market, weak overshifting for wheat flour and undershifting for meat (e.g., rye flour: 38.23 – 35.06 = 3.17 > 1.94, etc.).

One can nevertheless think of factors other than the tax that could explain the price differences. As the tax was more likely to be levied in large towns with (possibly) higher price levels one could speculate that Laspeyres just measured a spurious correlation. Given the large differences between the advanced western parts and the backward East of Prussia, one could also think of regional idiosyncrasies that affected the output prices of flour and meat, such as wages and other input prices. E.g., the high mean of the beef prices in non-tax cities is driven by two Prussian cities adjacent to (non-Prussian) Hamburg, then the richest German city on per capita basis. Hence, when recalculating Laspeyres' results it may be sensible to control for these factors simultaneously.

The most important independent variable is the tax. While Laspeyres' approach was like using a dummy variable for the tax, we use actual tax rates in our regressions (except in Tables 6a and 6b). The actual tax rates include the state tax, which was uniform all over Prussia, and the individual municipal surtax which was in the range of 0 to 50 per cent of the state tax.[19] For the

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[19] Emil Blenck (1871), "Beiträge zur preussischen Staats- und Communal-Finanzstatistik", *Zeitschrift des königlich preußischen statistischen Bureaus*, 11, pp. 145-162, here p. 161. – This explains why our tax amounts in Table 2, col. vi, deviate slightly from Laspeyres' in Table 1, col. v.

production costs of rye flour and wheat flour we include grain prices and wages. Local cattle prices are not available.

Nationwide wage data are difficult to find for pre-1900 Germany. The earliest source for Prussia are wages paid in the Prussian forest domains.[20] These were, however, only recorded in retrospect by seemingly reluctant rangers and display an unusually large variance. Moreover, they are not available for many important industrial towns in the Western provinces. We rely on another source here which, to our knowledge, has been used very rarely so far. In 1883, Germany decreed a law that entitled workers to receive sickness benefits the amount of which was based on local minimum wages. Hence, all over Germany local commissions were charged with determining the minimum wage in their regions. Their work added up to a list of local minimum wages for several thousand cities, villages and even estates which was published by an official source since 1892.[21] We were able to find a private source that assembled and published the first official data of the list, presumably for 1885 (or 1884).[22] This date is ten years after the repeal of the milling and slaughter tax and thus will by and large still reflect the regional wage differences of 1873-74 and helps avoiding endogeneity. Table 3 (next page) summarizes the descriptive statistics of the population and wage data.

Taken together, we have the following data for the right hand side of the regression equations: the tax (including local surtaxes), grain prices, the wage level (of 1885) and city population (from the population census of 1871).

Before we proceed we have to check a possible problem, that is whether not only the flour prices, but the grain prices as well were affected by the tax, or, in other words, whether the tax was shifted backwards to the input producers, a case not analysed by Laspeyres. In Table 4 (next page) we show the results of regressions of rye and wheat prices against the tax and against either wages (model I) or provincial dummies (model II).

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[20]  Udo Eggert (1883), "Die Bewegung der Holzpreise und Tagelohn-Sätze in den preussischen Staatsforsten von 1800 bis 1870", *Zeitschrift des königlich statistischen preußischen Bureaus*, 23 (1883), pp. 1-44.

[21]  *Central-Blatt für das Deutsche Reich* (1892), pp. 717-783, and subsequent issues (approximately every five years).

[22]  J. Schmitz (1888), *Uebersicht der für die sämmtlichen deutschen Bundesstaaten im Gemässheit des § 8 des Reichsgesetzes betreffend die Krankenversicherung der Arbeiter vom 15. Juni 1883 festgestellen ortsüblichen Tagelöhne gewöhnlicher Tagearbeiter*, 2nd ed., Berlin et al.: Heuser.

Table 3: Descriptive Statistics of City Population and Minimum Wage Data

| | Non-tax cities | | | | Tax cities | | | |
| | | population 1871 | | wage 1885 | | population 1871 | | wage 1885 |
| Province | no. | mean | median | mean | no. | mean | median | mean |
|---|---|---|---|---|---|---|---|---|
| Prussia | 4 | 10,770 | 9,793 | 1.26 | 8 | 39,017 | 19,630 | 1.46 |
| Pomerania | 3 | 11,440 | 9,050 | 1.30 | 7 | 24,925 | 16,279 | 1.49 |
| Posen | 0 | - | - | - | 5 | 23,044 | 10,672 | 1.35 |
| Silesia | 11 | 11,627 | 10,687 | 1.13 | 14 | 30,110 | 15,347 | 1.18 |
| Brandenburg | 7 | 10,079 | 9,675 | 1.29 | 12 | 87,893 | 18,739 | 1.58 |
| Saxony | 17 | 21,108 | 13,436 | 1.64 | 7 | 19,198 | 15,120 | 1.65 |
| Schleswig | 9 | 21,059 | 11,521 | 2.17 | 0 | - | - | - |
| Hanover | 11 | 22,210 | 15,852 | 1.79 | 0 | - | - | - |
| Hesse | 6 | 21,528 | 14,882 | 1.94 | 1 | 91,040 | 91,040 | 2.40 |
| Westphalia | 11 | 19,436 | 16,593 | 1.88 | 0 | - | - | - |
| Rhine Province | 16 | 26,878 | 14,469 | 2.05 | 8 | 47,065 | 27,389 | 2.00 |
| Prussia | 95 | 19,384 | 12,937 | 1.71 | 62 | 43,226 | 17,139 | 1.52 |

Sources: *Jahrbuch für die amtliche Statistik des Preußischen Staats*, 4 (1876). Ed. by Königlich Statistisches Bureau, Berlin: Decker, pp. 61-70 (population); J. Schmitz (1888), *Uebersicht der für die sämmtlichen deutschen Bundesstaaten im Gemässheit des § 8 des Reichsgesetzes betreffend die Krankenversicherung der Arbeiter vom 15. Juni 1883 festgestellen ortsüblichen Tagelöhne gewöhnlicher Tagearbeiter*, 2nd ed., Berlin et al.: Heuser (wages).

Table 4: Impact Factors on Wheat and Rye Prices in Prussian Cities, 1873-74

| | Rye | | Wheat | |
| | I | II | I | II |
|---|---|---|---|---|
| Tax [Pf/kg] | -0.30* [0.13] | -0.05 [0.12] | -0.10* (0.04) | -0.01 [0.03] |
| Wages (log) [Marks/day] | +0.80 [0.46] | - | +2.28*** (0.49) | - |
| Provincial dummies significant at 5%-level | - | 6 | - | 8 |
| Constant | 17.17*** [2.37] | 21.99*** [0.33] | 15.51*** (2.55) | 28.65*** [0.29] |
| Average price [Pf/kg] | 21.01 | 21.01 | 26.79 | 26.79 |
| Observations (cities) | 148 | 148 | 144 | 144 |
| Adj. R2 | 0.06 | 0.47 | 0.20 | 0.44 |
| Prob(F) | 0.00 | 0.00 | 0.00 | 0.00 |

Notes: OLS. Model II contains 10 dummies for 11 Prussian provinces. Standard errors in parentheses [White-corrected if in brackets]. *, **, *** significant at 5, 1, 0.1 per cent level, respectively. Testing for population (in logs) or including wages in model II does not have mentionable impact on the results.

Sources: See text.

Model I, which includes wages, suggests that rye and wheat prices were significantly lower in tax cities, 30 and 10 per cent, respectively. The difference seems to make sense, as a larger share of the wheat production was traded internationally. Turning to model II, which tries to capture

Table 5: Impact Factors on Flour and Meat Prices in Prussian Cities, 1873-74

| Product | Rye flour | | | Wheat flour | | | Pork | Beef |
|---|---|---|---|---|---|---|---|---|
| Model | I | II | III | I | II | III | I+II | I+II |
| Tax [Pf/kg] | 1.90*** | 1.84*** | 1.93*** | 1.09*** | 1.13*** | 1.15*** | 0.54* | 0.82** |
| | [0.43] | [0.51] | [0.48] | [0.11] | [0.11] | [0.12] | (0.22) | [0.29] |
| Price for rye or wheat [Pf/kg] | 0.80** | 0.64 | 0.91* | 0.99* | 0.65 | 1.64** | - | - |
| | [0.28] | [0.46] | [0.46] | [0.41] | [0.38] | [0.63] | | |
| Wages (log) [Marks/day] | 2.61 | - | 2.51 | 1.81 | - | 0.33 | 12.81* | 20.55* |
| | [1.67] | | [1.65] | [1.76] | | [2.01] | (5.54) | [7.95] |
| Provincial dummies significant at 5%-level | - | 5 | - | - | 1 | - | 9 | 4 |
| Average price [Pf/kg] | 36.22 | 36.22 | 36.22 | 50.62 | 50.62 | 50.62 | 133.25 | 133.23 |
| Observations (cities) | 145 | 145 | 145 | 142 | 142 | 142 | 156 | 157 |
| Adj. R2 | 0.15 | 0.25 | 0.15 | 0.32 | 0.46 | 0.30 | 0.40 | 0.45 |
| Prob(F) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Notes: Models I and II OLS, model III 2SLS. Constant not reported. Model II contains 10 dummies for 11 Prussian provinces. Model III uses the tax, wages and ten regional dummies as instruments. Standard errors in parentheses [White-corrected if in brackets]. *, **, *** significant at 5, 1, 0.1 per cent confidence level, respectively. Testing for population (in logs) or dropping the wage variable in the flour regressions does not have mentionable impact on the results.

Sources: *Zeitschrift des königlich statistischen preußischen Bureaus*, 13 (1873). Ed. by Königliches Statistisches Bureau, Berlin: Königliches Statistisches Bureau, pp. 181-256; *ibid.*, 14 (1874), pp. 45-80, 401-442 (prices); *Deutsche Gemeinde-Zeitung*, 6 (1867), p. 437; Emil Blenck (1871), "Beiträge zur preussischen Staats- und Communal-Finanzstatistik", *Zeitschrift des königlich preußischen statistischen Bureaus*, 11, pp. 145-162, here pp. 161f. (taxes); J. Schmitz (1888), *Uebersicht der für die sämmtlichen deutschen Bundesstaaten im Gemässheit des § 8 des Reichsgesetzes betreffend die Krankenversicherung der Arbeiter vom 15. Juni 1883 festgestellten ortsüblichen Tagelöhne gewöhnlicher Tagearbeiter*, 2nd ed., Berlin et al.: Heuser (wages); *Jahrbuch für die amtliche Statistik des Preußischen Staats*, 4 (1876). Ed. by Königlich Statistisches Bureau, Berlin: Decker, pp. 61-70 (population) .

regional idiosyncrasies by using dummy variables rather than wages, we must conclude that the backshifting effect was numerically very low and insignificant. Since just taking wages is presumably not sufficient to control for regional idiosyncrasies and since the explanatory power of model II is much higher, one might be tempted to attach more value to this model, which clearly rejects backshifting.[23]

We nevertheless should keep in mind that backward shifting might play a role. For this reason, we test in our recalculation of the Laspeyres-Paradox a third model for our regressions on the flour and meat prices which controls for endogeneity of grain prices (see Table 5 above).

For the interpretation it is important to keep in mind that the price and tax variables are not expressed in logarithms, which allows a straightforward interpretation of the coefficients.[24] Our focus is on the coefficients of the tax variable which indicate the amount of tax shifting. For example, the coefficient of the first model for rye flour indicates that an increase of the tax by one *Pfennig* increases the price for rye flour by 1.9 *Pfennig* (or 190 per cent of the tax amount). Thus all three models signal strong overshifting in the rye flour market. For the wheat market, the results indicate weak overshifting, whereas the slaughter tax was not fully shifted forwards to the consumers—but remember that for lack of cattle price data, we cannot assess in how far the slaughter tax was shifted backwards. As cattle was traded regionally, backshifting appears quite plausible. The coefficients for the production inputs make sense. An increase of the grain price of 1 *Pfennig* led to a similar increase of the flour price, and higher wages also went along with higher flour and meat prices. Hence, Laspeyres' results can be fully reproduced even if we control for more variables than he could, especially the large structural differences between the various Prussian provinces.

### IV. What Caused Overshifting?

How can we explain our findings (and those of Laspeyres)? The *relative* differences in forward shifting—slaughter tax undershifted, milling tax weakly overshifted in the wheat flour market and strongly overshifted in the rye flour market—may be due to different price elasticities of demand. Yet this does not explain the unexpectedly high *levels* of tax shifting in the flour markets.

Before we turn to the theoretical approaches introduced in section II, we discuss a phenomenon often mentioned in the contemporary literature: smuggling. Smuggling livestock or

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[23] Skeptical readers should note that any backshifting *increases* the gap between flour prices with and without the tax to be explained.

[24] This estimation strategy has the disadvantage that we run a higher risk of heteroscedasticity. Thus standard errors are corrected by the White procedure, if appropriate.

meat into the cities was difficult. What people did smuggle on sizeable scale was flour. The authorities complained that smuggling flour was a kind of common sport of the urban poor. An interesting feature is that, according to the Prussian finance minister in an aide-memoire for a parlamentary hearing, no smuggler would ever smuggle rye flour, all those who were captured had the more expensive wheat flour with them.[25] This must have put downward pressure on the prices of wheat flour, and, to a lesser extent, of rye flour as well, because it was a partial substitute. In respect to explaining the Laspeyres-Paradox, however, this argument works in the opposite direction, as we find for flour overshifting, not undershifting. If any, this may, along with the elasticity argument, help to explain the difference in overshifting between wheat flour and rye flour.

It is interesting to note that when the smugglers decided to focus on wheat flour they followed precisely the rationale that is behind the quality argument of Barzel. Being caught with a given quantity of contraband would lead to a penalty regardless of its value (within limits). Thus the smugglers focused on wheat flour which was, relative to the price, much higher taxed than either rye flour or meat (Table 1, col. vi).

The same reasoning held for the legal trade in livestock and meat. There is convincing anecdotal evidence that the quality of meat was definitely better in tax cities than in non-tax cities.[26] The reason given by the contemporary literature mirrors exactly Barzel's argument. As the slaughter tax was levied per piece or weight of cattle, there was an incentive to bring high-quality livestock in the tax cities. This explanation, however, also works in the wrong direction, as an improvement of quality would explain overshifting in the meat market, not, as observed, undershifting. In contrast, there is not a single hint in the contemporary literature that the flour consumed in tax cities was of superior (or inferior) quality.[27]

What about the second argument of the theoretical literature, that is imperfect competition? It should be clear that any argument that rests on imperfect competition must explain why there were barriers to competition in the tax cities but not in the non-tax cities. In this respect it is interesting to note that the milling and slaughter tax law of 1820 stipulated that the establishment

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[25] Von Düesberg (1847), "Denkschrift betreffend die Aufhebung der Mahl- und Schlachtsteuer, die Beschränkung der Klassensteuer und die Erhebung einer Einkommensteuer", in Eduard Bleich (ed.), *Der Erste Vereinigte Landtag in Berlin 1847*, vol. I, Berlin: Reimarus, pp. 40-64, here p. 60.

[26] For references, see Mark Spoerer (2004), *Steuerlast, Steuerinzidenz und Steuerwettbewerb. Verteilungswirkungen der Besteuerung in Preußen und Württemberg (1815-1913)*, Berlin: Akademie, p. 156. See also *Deutsche Gemeinde-Zeitung*, 14 (1875), p. 100.

[27] According to Napoleon Weinhagen (1872), *Gegen die Schlacht- und Mahlsteuer. Ein Memento für die Stadtverordneten von Köln*, Cologne, pp. 7-9, the quality of bread in Cologne (which levied the milling tax) was *negatively* affected by the difference of the tax rates on wheat flour and rye flour.

of grain mills was subject to government approval.[28]  Thus one can speculate that the local authorities made restrictive use of this rule either deliberately to protect existing businesses or unintentionally, perhaps because they constantly underestimated the pace of city growth.

How can we test imperfect competition?  Profit data are not available, but data on the number of businesses and their employees are.  This may give clues on whether there was business concentration among the grain mills, bakeries or butcheries in tax cities.[29]  The only business census which falls into the period of the milling and slaughter tax and which has detailed information on grain mills, bakeries and butcheries is that of 1849 (139 cities).  The one census that is close to our year of investigation, 1873-74, dates from the first of December 1875, that is eleven month after the milling and slaughter tax became ineffective.  It is nevertheless plausible that the market structure that had developed under the tax regime was still existent eleven months after the repeal of the tax.  Thus it might be worthwile to analyse this data set of 54 Prussian cities as well.

Table 6a: Impact Factors on Density and Size of Grain Mills, Bakeries and Butcheries in 139 Prussian Cities, 1849

|  | Businesses per 1,000 population | | | Employees per business[a] | | |
|  | Mills | Bakeries | Butcheries | Mills | Bakeries | Butcheries |
| --- | --- | --- | --- | --- | --- | --- |
| Tax (0/1) | 0.02 | -0.66*** | -0.70*** | 0.68 | 0.20* | 0.20** |
|  | [0.17] | [0.16] | [0.16] | [0.67] | [0.09] | [0.07] |
| Population (log) | -0.24* | -0.56*** | -0.37*** | 0.58** | 0.43*** | 0.14*** |
|  | [0.10] | [0.10] | [0.09] | [0.21] | [0.06] | [0.04] |
| Provincial dummies significant at 5%-level | 3 | 6 | 3 | 0 | 6 | 4 |
| Constant | 2.63** | 9.50*** | 6.61*** | -1.51 | -2.31*** | 0.22 |
|  | [0.91] | [1.08] | [0.93] | [2.36] | [0.54] | [0.35] |
| Average dep. variable | 0.98 | 2.63 | 2.28 | 3.21 | 2.29 | 1.87 |
| Observations (cities) | 139 | 138 | 138 | 135 | 138 | 138 |
| Adj. R2 | 0.41 | 0.58 | 0.33 | 0.08 | 0.52 | 0.33 |
| Prob(F) | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |

Notes: OLS.  The Model contains 6 dummies for the 7 Prussian provinces.  Standard errors in parentheses [White-corrected if in brackets].  *, **, *** significant on 10, 5, 1, 0.1 per cent level, respectively.  [a] Owners included.

Sources: Sources: *Tabellen und amtliche Nachrichten über den Preussischen Staat für das Jahr 1849*, Berlin: Hayn, vol. I (1851), p. 276, vol. IV (1853), pp. 152-162, vol. V (1854), pp. 1-821.

Both tables show that the density and size of grain mills was neither in 1849 nor in 1875 influenced by the tax.  Bakeries and butcheries, in contrast, were heavily affected by the tax.  For 1849 the results of Table 6a show clearly that there was concentration both in the bakery and in

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[28]  §7b, see Ernst Engel (1868), "Die Ergebnisse der Classensteuer, der classificirten Einkommensteuer und der Mahl- und Schlachtsteuer im Preussischen Staate", *Zeitschrift des königlich statistischen preußischen Bureaus*, 8, pp. 25-84, here p. 32.

[29]  The Prussian business censuses of the nineteenth century did not give details on grain or cattle traders.

the butchery business. If we control for population and regional variation the average size of bakeries and butcheries was about 10 per cent larger in tax cities than in non-tax cities. Consequently, there were less bakeries and butcheries in tax cities than in non-tax cities.

Table 6b: Impact Factors on Density and Size of Grain Mills, Bakeries and Butcheries in 54 Prussian Cities, 1875

| | Businesses per 1,000 population | | | Employees per business[a] | | |
|---|---|---|---|---|---|---|
| | Mills | Bakeries | Butcheries | Mills | Bakeries | Butcheries |
| Tax 1874 (0/1) | 0.01 [0.03] | -0.27° [0.16] | -0.00 (0.19) | 0.92 [3.48] | 0.64** (0.23) | 0.12 (0.15) |
| Population (log) | -0.10° [0.05] | -0.16* [0.07] | -0.08 (0.09) | -0.38 [2.57] | 0.46*** (0.12) | -0.00 (0.08) |
| Wages (log) | -0.17 [0.21] | -0.70** [0.24] | -0.99* (0.43) | -25.85 [16.71] | 1.01° (0.55) | 0.99** (0.36) |
| Provincial dummies significant at 5%-level | - | 10 | 4 | - | 9 | 6 |
| West (0/1) | -0.06 [0.04] | - | - | 2.08 [4.10] | - | - |
| Constant | 1.37* [0.63] | 5.04*** [0.70] | 3.37*** (0.84) | 30.19 [32.36] | -3.79** (1.11) | 1.09 (0.71) |
| Average dep. variable | 0.11 | 1.88 | 1.67 | 9.31 | 2.96 | 2.21 |
| Observations (cities) | 24 | 54 | 52 | 23 | 54 | 52 |
| Adj. R2 | 0.28 | 0.78 | 0.34 | 0.19 | 0.64 | 0.38 |
| Prob(F) | 0.03 | 0.00 | 0.00 | 0.40 | 0.00 | 0.00 |

Notes: OLS. The Model contains 10 dummies for the 11 Prussian provinces (except for mills: to increase the degrees of freedom a simple dummy variable is used which indicates whether the city belongs to the western provinces or not). Standard errors in parentheses [White-corrected if in brackets]. °, *, **, *** significant on 10, 5, 1, 0.1 per cent level, respectively. [a] Owners included.

Sources: *Die definitiven Ergebnisse der Gewerbezählung vom 1. December 1875 im preussischen Staate* (Preussische Statistik, 40.1), vol. 1, Berlin: Verlag des Königlich Statistischen Bureaus 1878, pp. 48, 289-413, and vol. 2 (Preussische Statistik, 41) (1880), pp. 462-466, 470-472.

In 1875 there is no evidence that the size or density of butcheries still differed in the two city groups. The coefficients are close to zero and insignificant on conventional levels. The results for the bakeries, however, suggest that concentration still persisted. If we control for population, wages and regional variation, the typical bakery in a (former) tax city occupied on average 0.6 employees (22 per cent) more than in non-tax cities. The analysis of the susbsequent business censuses shows that this tax-induced effect slowly petered out. In 1882 and 1895, bakeries in former tax cities were still 16 per cent and significantly larger than in former non-tax cities. In 1907, the difference amounted to only 6 per cent and was insignificant. In none of the regressions that use these census data is the coefficient of the tax variable significant for the density or size of grain mills or butcheries, respectively.[30] Hence we can infer that it was

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[30] The sources for these calculations are for the census of 1882 *Die Gewerbebetriebe im preussischen Staate nach der Aufnahme vom 5. Juni 1882. Uebersichten der einzelnen Kreise* (Preussische Statistik, vol. 83/2), Berlin: Verlag des König-

especially the market structure of the bakery business that was affected by the tax. The mimimum efficient scale was clearly larger and the magnitude and sign of the density variable suggests that there were probably remnants of concentration.

However, as the industrial organization literature points out, concentration does not necessarily imply market power. And there is ample anecdotal evidence that not only the butchers but the bakers alike vividly rejected the tax.[31] Hence the concentration was very probably not a result of a tax-induced increase of market power. We thus have to look for another argument that is able to reconcile the finding that the bakery business experienced overshifting and an increase of the minimum efficient scale in the tax cities, whereas the butchery business was not able to shift the tax burden to the consumers and was no longer concentrated in the 1870s.

A more detailed look at the contemporary discussion offers an alternative interpretation. When the Netherlands abolished a similar tax in 1866 the bakeries realized sizable cost reductions.[32] Is it conceivable that tax collection and monitoring caused considerable surplus costs in the Prussian bakery business as well? There is some evidence on the costs. The milling and slaughter tax was extremely expensive to collect. The state had to sustain the tax line around the tax cities. Thus the costs did not only cover the tax administration, but the maintenance of the city walls and gates as well, which had been preserved only for the purpose of collecting the milling and slaughter tax. The ratio of collection costs to gross revenues was on average between 15 to 20 per cent, which was much higher than for every other Prussian tax. In small cities, this ratio would even increase to 40 per cent.[33]

These costs were borne by the state. For our problem it is more interesting to see whether there were tax-induced surplus costs imposed on bakers or butchers. Controlling the butchers did not require a sophisticated procedure, as livestock was difficult to hide. Every butcher had to

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lichen Statistischen Bureaus 1885, pp. 468-592; *Gewerbestatistik des Reichs* (Statistik des Deutschen Reichs, vol. 6/1), Berlin: Puttkammer & Mühlbrecht 1886, pp. I.64-I.109; *Gewerbestatistik der Großstädte* (Statistik des Deutschen Reichs, vol. 6/2), Berlin: Puttkammer & Mühlbrecht 1886; for the census of 1895 *Gewerbe-Statistik der Verwaltungsbezirke* (Statistik des Deutschen Reichs, n.s., vol. 117/1), Berlin: Puttkammer & Mühlbrecht 1898; and for the census of 1907: *Gewerbliche Berufsstatistik, Abt. VI: Kleinere Verwaltungsbezirke; Preußen (Berufs- und Betriebszählung vom 12. Juni 1907)* (Statistik des Deutschen Reichs, n.s. vol. 218), Berlin: Puttkammer & Mühlbrecht 1909. Wage data from Schmitz (1888) and *Central-Blatt* (1892), pp. 717-783, (1897), pp. 421-488, (1905), pp. 399-475.

[31] See, e.g., F. Schemioneck (1863), *Die Mahl- und Schlachtsteuer in Berlin*, Berlin: Selbstverlag p. 3; *Denkschrift über die Mahlsteuer und ihre nachtheiligen Folgen für die weniger bemittelten Volksklassen, sowie insbesondere für das Bäckergewerbe. Hrsg. v. Vorstande der Bäcker-Corporation in Köln*, Cologne: Bachem 1869; and especially Hans Teschemacher (1912), *Die Einkommensteuer und die Revolution in Preußen. Eine finanzwissenschaftliche und allgemeingeschichtliche Studie über das preußische Einkommensteuerprojekt von 1847*, Tübingen: Laupp, pp. 26f.

[32] Ludwig Bamberger (1870), Die Aufhebung der indirekten Gemeindeabgaben in Belgien, Holland und Frankreich, *Vierteljahrschrift für Volkswirtschaft, Politik und Kulturgeschichte*, 8, pp. 22-54, here pp. 42, 45f.

[33] Cf. *Verhandlungen des Hauses der Abgeordneten. Sammlung sämmtlicher Drucksachen des Hauses der Abgeordneten*, vol. 225, Berlin 1870, pp. 665-671.

keep books of his livestock which could be updated by the authorities only. Livestock that came into the city was added to his books, animals slaughtered under guidance of the authorities were subtracted. Any illegal import or slaughtering would have led to a mismatch of actual stock with the records in the books.[34]

Whereas the quantity and type of livestock was easily controlled, that of grain or flour was not. The controls at the city gates and within the mills were to avoid three illegal practices: smuggling grain or flour into the cities, importing high-taxed wheat (flour) declared as low-taxed non-wheat grain (flour) and clandestine grain milling. For these reasons any incoming flour was taxed at the city gate, whereas the procedure was much more complicated with grain. Incoming grain was registered and thoroughly checked at the gate. The importing trader or baker had to specify the type of grain, number and weight of sacks, name and residence of the taxpayer, planned processing and mill. The importer would then receive a tax voucher which entitled him to have his load weighed. Only then was he allowed to proceed to the mill, where the milling process had to be constantly supervised by an official of the authorities. The millers were also subject to intense monitoring. Flour was to be stored only in specified rooms the access to which was strictly controlled. Grain traders, millers and bakers criticized most that they had to wait days or even weeks to get the grain milled. Storing it tied capital and risked that the produce rotted. On top of these indirect costs the tax authority forced the millers to pay the official supervisors' salaries.[35] A contemporary author called these tax-induced surplus costs a "second tax", and an anonymous author conjectured as early as 1848 that a repeal of the tax would result in a price decrease larger than the tax precisely because of the abolition of institutional impediments.[36]

Thus we can expect that the tax collection and monitoring process induced an increase of costs. It is clear that marginal costs must have increased due to the handling of the bureaucratic procedures and the wastage due to the waiting time. If, for the moment, we assume that fixed costs were unimportant in the bakery business we can visualize the total welfare losses in Figure 2.

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[34] A usually well-informed contemporary source confirms that the butchery business was much less affected by tax-induced surplus costs than the bakery business, see *Deutsche Gemeinde-Zeitung*, 11 (1872), p. 26.

[35] Schemonieck (1863), pp. 6, 16. See also Otto Wolff (1864), "Die Mahl- und Schlachtsteuer", *Vierteljahrschrift für Volkswirtschaft, Politik und Kulturgeschichte*, 2, pp. 168-196, here 196; Max von Heckel (1893), "Schlacht- und Mahlsteuer", in *Handwörterbuch der Staatswissenschaften*, 1st edn., vol. V, Jena: Fischer, pp. 571-576.

[36] David Born (1850), *Denkschrift über den Einfluß der Mahl- und Schlachtsteuer auf die gewerblichen Verhältnisse Berlins, besonders in Bezug auf die Arbeitslöhne und auf die Konkurrenzfähigkeit andern Städten gegenüber*, Berlin: Buchdruckerei der Reform, p. 7 (our translation); Anonymous (1847), *Nachtrag über die Nothwendigkeit der Umwandlung der Mahl- und Schlachtsteuer* [...], Halle: Schwetschke und Sohn, p. 5.

Figure 2: The Effect of the Milling Tax on the Price of Flour (no fixed costs)
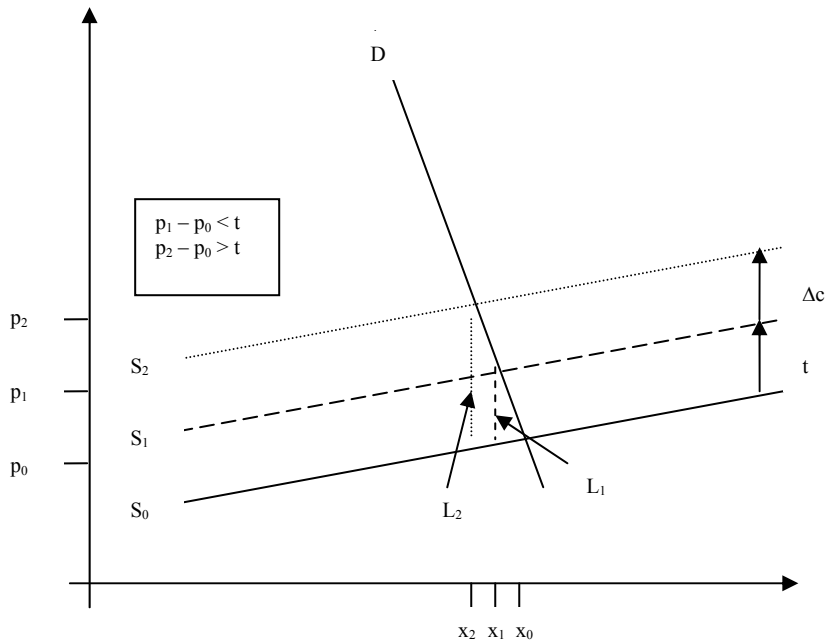


In the common partial analytic framework the introduction of a specific production tax causes a shift of the supply curve from $S_0$ to $S_1$ by the tax amount t which produces a welfare loss of the triangle $L_1$. The argument put forward here is that the milling tax imposed considerable surplus costs $\Delta c$ that increased the supply curve even further, from $S_1$ to $S_2$, inducing a welfare loss of triangle $L_2$.

This is probably not the whole story, as it cannot explain the strong and significant impact on the mimimum efficient scale of the bakeries. Ignoring fixed costs is probably not very realistic. The requirement of an increase of grain storage capacity must have caused additional fixed (and/or step-variable) costs which were probably substantial. Figure 3 visualizes this effect.

If fixed costs were present, but were not affected by the tax, the tax-induced increase of the marginal costs would have had no effect on minimum efficient scale x*; the intersection of the marginal cost curve and the average cost curves just moves up vertically ($E_0 \rightarrow E_1$; $x_0{}^* = x_1{}^*$). If, however, the tax regime affected both fixed and marginal costs, the minimum efficient scale went up ($E_0 \rightarrow E_2$; $x_0{}^* = x_1{}^* < x_2{}^*$). This explains why there were less and larger bakeries in tax cities.

Figure 3: The Effect of the Milling Tax on the Price of Flour (with fixed costs)
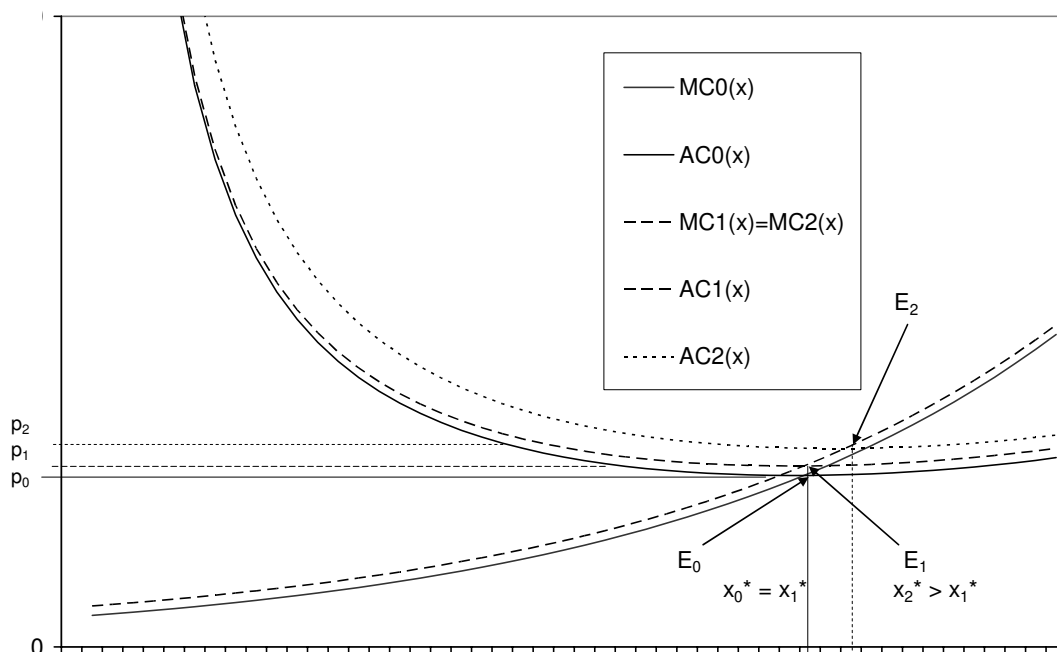


Figures 2 and 3 also explain the Laspeyres-Paradox. While Laspeyres believed to measure an effect of size $p_1 - p_0$ and wondered how this could exceed the tax t, he really observed $p_2 - p_0$, which, given the low price elasticity of demand for grain and especially rye products, was larger than t.

To summarize, the Prussian milling tax caused unusually large costs. The producers had to bear surplus marginal costs and very probably surplus fixed costs which they put on the sales price. The consumers had to pay flour prices that were considerably higher than in non-tax cities and the state bore larger collection costs than with any other tax.

## V. Conclusion: The Political Economy of the Milling and Slaughter tax

This paper has shown that, while the French economist Augustin Cournot is the theoretical mastermind of today's literature on tax overshifting, the German economist Etienne Laspeyres should be seen as the empirical forebear. The overshifting of the Prussian milling tax that he observed, however, cannot be explained by today's theoretical approaches. The reason must be sought in considerable surplus costs that were induced by the still quite primitive means to monitor the tax collection process in nineteenth century Prussian cities.

One question, however, has so far remained unaddressed. If the Prussian milling and slaughter tax caused high costs to producers, consumers and the state alike, why then was it in existence for more than half a century without any major change?

The answer lies in the distributional effects of the tax. The Prussian state levied the unpopular milling and slaughter tax, monitored its collection in the cities and had to defend it against political attacks. Since 1848, a third of the revenues were left to the cities. On top of that the cities levied municipal surtaxes. Hence the Prussian state collected the tax both for his own coffers and those of the tax cities. The cities merely had to pay a small contribution to the state for his collection efforts.[37] In many cities, the revenues from the milling and slaughter tax formed the backbone of their finances.

Table 7: Milling and Slaughter Tax Revenues as Share of Total Municipal Tax Revenues, 1869 (per cent)

| Berlin | 28 | Cologne | 31 | Magdeburg | 48 | Spandau | 55 |
|--------|-----|-----------|-----|-----------|-----|---------|-----|
| Breslau | 32 | Königsberg | 32 | Potsdam | 47 | Torgau | 100 |

Source: Ludwig Herrfurth (1878), "Beiträge zur Statistik der Gemeindeabgaben in Preussen. Unter Benutzung amtlicher Quellen bearbeitet", *Zeitschrift des königlich statistischen preußischen Bureaus*, 18, pp. 1-60, here p. 27.

The regressive character of the tax, strikingly demonstrated by the economist Carl Kries who compared the tax load of his university professor household with that of a child-rich worker household accross the street, was obvious.[38] Hence the urban poor contributed considerably to the local public revenues. For the wealthy, the relative burden of the milling and slaughter tax was minimal. There was even tax-induced migration of the rich into the tax cities. If a rural resident was able to convince the tax office that he spent at least six months of the year in a city that levied the milling and slaughter tax, he was exempted from the class tax.[39] Had the milling and slaughter tax been repealed, the cities would have had to find an alternative. As numerous contemporary voices pointed out, this would inevitably have resulted in a direct tax, that is a tax that had to be borne by the wealthy much more than the indirect milling and slaughter tax. These motives were publicly discussed by contemporary politicians, journalists and academics.[40]

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[37] Friedrich G. Schimmelfennig (1840), *Die preussischen indirekten Steuern oder die auf Produktion, Fabrikation und Konsumtion ruhenden Abgaben im Innern der preussischen Staaten. Eine systematisch geordnete Zusammenstellung der darauf Bezug habenden Gesetze und Verordnungen bis zum Schlusse des Jahres 1835*, vol. II, Potsdam: Riegel, p. 50; A. Reinick (1863/64), "Resultate der Mahl- und Schlachtsteuer in der Periode von 1838 bis mit 1861. Eine finanz-statistische Abhandlung", *Zeitschrift des königlich preussischen statistischen Bureaus*, 3, pp. 217-235, 4, pp. 160-167, here p. 163.

[38] Carl G. Kries (1849), "Über die Mahl- und Schlacht-Steuer, die Einkommen- und Klassen-Steuer in Preußen", *Archiv der politischen Oekonomie und Polizeiwissenschaft*, n.s. 8, pp. 179-224, 277-324, here pp. 189f..

[39] See on tax-induced migration and tax competition in nineteenth century Germany Mark S. Hallerberg (1996), "Tax Competition in Wilhelmine Germany and its Implications for the European Union", *World Politics*, 48, pp. 324-357; Mark Spoerer (2002), "Wann begannen Fiskal- und Steuerwettbewerb? Eine Spurensuche in Preußen, anderen deutschen Staaten und der Schweiz", *Jahrbuch für Wirtschaftsgeschichte*, no. 2, pp. 11-35, here pp. 44f.; idem (forthcoming 2007), "The Political Economy of Taxation in 19th Century Germany", in Alexander Nützenadel and Christoph Strupp (eds.), *Taxation, State and the Civil Society in Germany and the United States, 1750-1950*, Wiesbaden: Nomos.

[40] See, e.g., Schemonieck (1863), p. 5; *Deutsche Gemeinde-Zeitung*, 2 (1863), pp. 269f., 6 (1867), p. 291; *Denkschrift* (1869), pp. 1, 7; Weinhagen (1872), pp. 11-14; Georg von Mayr (1890), "Mahl- und Schlachtsteuer", in *Wörterbuch des deutschen Verwaltungsrechts*, vol. II, Freiburg i.B.: Mohr, pp. 64-68, here p. 65.

It is thus not surprising that there was one group that was outspokenly in favour of this tax: the urban rich.[41] They controlled most city councils as well as the Prussian Lower House and voted in 1851 and as late as 1869 successfully against the repeal of the milling and slaughter tax. Lobbying for a tax that was annoying for everyone (at the least because of the onerous controls at the city gates) and that was regarded as inefficient by many contemporary authors thus made nevertheless perfect sense for this group. Only when after the successful Franco-Prussian war of 1870-71 and the payment of the French war indemnity the situation of German public finances was in an unusually good shape and when public pressure against the milling and slaughter tax increased to an unprecedented level did this group give in, and the tax was repealed.

In essence, lobbying for maintaining the milling and slaughter tax was a result of rent-seeking behaviour. Insofar it was probably the milling and slaughter tax that should have been called 'class tax' as its incidence fell on the urban poor in a much more pronounced way than even the Socialist Ferdinand Lassalle had dared to claim.

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[41] Schemonieck (1863), p. 5; *Denkschrift* (1869), p. 17; and for a detailed case study Hans-Werner Hahn (1987), "Zunftproteste gegen den modernen Steuerstaat: Die Wetzlarer Auseinandersetzungen um die preußische Mahl- und Schlachtsteuer 1820-1840", *Nassauische Annalen*, 98, pp. 173-198.

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