

Polish business flat tax and its effect on reported incomes

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Comments more than welcome*

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Abstract

The 2004 tax reform in Poland introduced a broad-base low-rate “flat” tax for business income. For the highest income taxpayers, the marginal tax rate fell from 40% to 19% at the cost of giving up tax preferences (broadening the base). The reform provides an opportunity to exploit difference-in-difference strategies relying on differential benefits from the reform among otherwise similar individuals, such as due to characteristics of the spouse. Relying on a large panel of individual tax return data we find very large increases in reported incomes and moderate tax revenue implications. These responses are most likely operating through reduction in tax avoidance or participation in gray economy and suggest that when avoidance margin is responsive base-broadening combined with marginal tax rate reductions can be welfare improving. The paper highlights empirical issues involved in estimating responsiveness of taxable income and suggests that violation of exclusion restrictions and heterogeneous earnings dynamics are likely responsible for “sensitivity” of results claimed elsewhere in the literature.

1 Introduction

In the last 10 years, a number of Eastern and Central European countries introduced the so called “flat taxes.” Proponents of this type of taxation appeal to its significant benefits due to improved work economic activity incentives, reduced tax evasion and the size of informal economy. Opponents highlight reduction in progressivity of the tax code. More generally, flat tax reforms combine broadening of the tax base and tax rate reductions: a combination that can in principle reduce distortions, simplify tax system and have limited tax revenue consequences both due to base expansion and due to behavioral response to lower marginal tax rates, explaining their appeal to policy makers. Despite significant popularity that this type of taxation has enjoyed, evaluation of its effects has been limited (exceptions are Ivanova et al., 2005; Gorodnichenko et al., 2009).

A type of a “flat tax” has been and is considered as a potential direction of a reform of the tax code in Poland. The idea of introducing the flat tax has been floated during the most recent electoral campaign by the Civic Platform, the dominant party in the current coalition government. While a widespread flat tax has not yet been introduced in Poland, a limited form of such taxation was introduced in 2004. The 2004 reform offered individuals engaged in business activity the choice between filing according to the regular progressive schedule or being subject to a fixed rate. The key benefit of relying on the flat rate schedule is the lower marginal tax rate: the flat tax rate is 19%, while the three-bracket progressive schedule involves three rates of 19%, 30% and 40%, with the top rate applying at 74,048zł in 2004.¹ There is a trade-off involved in electing the flat tax rate, with the cost having to do with elimination of tax deductions and credits as well as with giving up income averaging opportunity for married individuals. We discuss the reform in more details in what follows. A similar reform proposal has also been floated during the 2008 presidential campaign in the United States by John McCain.

The limited scope of the reform provides a unique opportunity to identify the impact of a flat tax on individual behavior. This is so, because individuals who are otherwise similar may be affected differently depending on their personal tax situations. For example, it is more costly for individuals with a high-income spouse to choose the flat tax regime due to the elimination of the possibility for joint filing and resulting tax averaging.² Similarly, the change did not apply to all types of income and hence provides an opportunity for identification based on comparing behavior of taxpayers with different income streams. Hence, one

¹This rate is of the order of \$20000 using the exchange rate in 2004 (1zł appreciated from 0.25\$ to 0.33 over the course of that year). The average salary in 2004 in Poland was 2,289zł per month or 27,468zł annually.

²There is no separate tax schedule for married individuals, instead the tax code allows for income averaging across spouses with tax liability of each spouses computed based on the half of joint taxable income.

does not have to rely solely on the time variation or differences across income groups, but can further take advantage of the natural experiment that generates cross-sectional variation in the change in tax incentives.

Business income “flat tax” that was introduced in Poland is characterized by low marginal tax rate and broad tax base. We will not try to distinguish between the effect of those two dimensions of differences, although some empirical strategies to do so have been proposed (Kopczuk, 2005). As a result, we are estimating the joint impact of these two qualitative changes in the tax code.

Our objective in this work is to evaluate the impact of flat taxes on reported taxable income and try to infer the source of response. In doing so, we are advancing the knowledge of the responsiveness to tax incentives in a number of ways. We are estimating responsiveness of reported income in Poland. Results are of interest from the Polish point of view but they are also of interest more generally. This is the first taxable income study applying to a middle-income country and, arguably, the first one applying to a situation with a significant informal economy. Hence, the estimated responses are likely to generalize better than estimates from high-income countries to situations with high tax evasion. Naturally, other middle and lower income countries are one such example, but there are also similarities to taxation of entrepreneurial income in advanced economies. For example, according to the IRS estimates of the tax gap in 2001, underreporting of business income accounts for approximately half of the individual income tax gap, corresponding to the underreporting rate of the order of 40% and exceeding 50% for non-incorporated businesses (underreporting rate for all sources of income is estimated at 11%³). Hence, finding of a significant reaction to changes in taxation of entrepreneurial income in a high-evasion environment is also of potential relevance for policy makers in high-income countries.

The paper also contributes to the literature on the responsiveness of taxable income more generally. By focusing on a context with explicitly and cleanly defined treatment and control groups, it is possible to get a better insight into the nature of econometric problems plaguing this literature (see Saez et al., 2009, for a discussion) and evaluate credibility of the identification strategy. I pursue a “graphical” approach to illustrate the effects and highlight the problems, in particular those related to mean-reversion and assumptions behind the identification strategy. While such an approach may not easily generalize to context that cannot be described by a binary treatment variable, it is very useful for illustrating the nature of the problems and disputing the common claim in the taxable income literature that the

³Between \$83 and \$99 out of the estimated individual income gap of \$150-187 billion (http://www.irs.gov/pub/irs-utl/tax_gap_facts-figures.pdf), misreporting rates based on http://www.irs.gov/pub/irs-news/tax_gap_figures.pdf, accessed on 2/12/2009.

results are “sensitive.” I argue that sensitivity is a consequence of violations of identifying assumption and poor understanding of the data. For example, I show that mean-reversion patterns for entrepreneurs and wage-workers are very different so that a strategy that relies on treatment correlated with self-employment status needs to take into account the presence of such differences or else is bound to effectively assign them to a tax response. Similar problems are likely to arise in other situations where empirical strategy relies on comparison of groups with different earnings dynamics, for example when different income groups are compared.

The structure of the paper is as follows. In Section 2 I describe the data and in Section 3 discuss the Polish tax system. Section 4 presents basic summary statistics suggesting that the reform likely had an important effect on reported income. In section 5 I provide causal estimates of the reform. I proceed in two ways. First, following suggestions of Saez (2004) and Saez et al. (2009) I employ repeated cross-sectional analysis but conclude that while it illustrates the impact of the reform, it is inadequate for precisely estimating its effect due to the rank-reversal problem. Second, exploiting the panel dimension of the data, I pursue a number of instrumental variables strategies relying on pre-determined characteristics of the spouse or an individual. I provide graphical evidence showing that several a priori appealing instruments (such as owning a business or having high-income spouse) violate the exclusion restrictions that translate into “sensitivity” of the results to specification. When I focus on a more homogenous sample of consistent business owners, there is no longer evidence of a relationship of several instruments such as spousal income or spousal business ownership to earnings dynamics and the results are consistent and stable. I find that the effects of the reform on reported incomes are very large and the effects on tax liability are nonlinear (varying with income level). Section 6 concludes and draws some implications.

2 Data

The empirical approach takes advantage of individual tax return data from the Polish Ministry of Finance. The data covers period from 2002 to 2005 and includes all individual tax returns filed during that time by approximately 1.8 million individuals and their spouses (to the extent that they could be identified based on filing a joint income tax return), altogether a little bit over 10 million returns. Sampled individuals were selected randomly from among those who filed at any time during the period (the likelihood of being selected did not depend on the number of returns or the number of times that one filed). This procedure corresponds to selecting a random sample of the population and then limiting it to those who filed at least once during the period.

Following the selection of the taxpayers, joint tax returns filed during 2002-2005 were used to identify spouses. All tax returns of spouses identified in that way were added to the dataset. Taxpayers who divorced or widowed and then remarried can have multiple spouses in the dataset and returns for each spouse will be available for all years. On the other hand, filing jointly is a choice and not a requirement so that not all couples can be identified and it is not possible to distinguish changes in election of how to file from divorces or deaths. Furthermore, and importantly given the reform studied, the flat tax does not allow for joint filing so that information about spouses of taxpayers who report business income only and use the flat tax schedule is not directly available in 2004 and 2005 (but to reiterate, 2004 and 2005 tax returns of their spouses with whom they filed jointly in 2002 or 2003 are still available).

As usual with tax data, it is rich in details from tax returns (most of the lines from tax returns are reflected in the dataset) but relatively thin on demographic information (gender, age and population at the place of residence are available; presence of children and marital status are available to the extent that tax return reveals that information).

For the purpose of analysis in this note, we aggregate information from all tax returns filed by a given individual.⁴

3 Polish tax system

The regular income tax in Poland has been in effect since the early 1990s and has a fairly typical progressive structure. The basic rate structure of the tax remained fairly stable since the late 1990s. There are three tax brackets with marginal tax rates of 19%, 30% and 40%. There is also a non-refundable tax credit applicable to everyone that effectively implements an exemption from tax for low levels of income. Between 2002 and 2006, tax brackets were fixed in nominal terms, at 37024 zł and 74048 zł. The tax credit was equal to 518.16zł in 2002 and adjusted to 530.08zł for 2003-2006.

The option to choose between the progressive rate rate schedule and the flat rate (19%) for non-agricultural business activity was made effective as of 1 January 2004. The fixed

⁴All personal information has been removed from the dataset so that taxpayers cannot be identified. Furthermore, numerical variables have been blurred to preserve confidentiality of the taxpayers. The blurring procedure was performed by selecting for each tax return a random number from a uniform distribution between 0.9 and 1.1 and multiplying all the monetary variables on a given tax return by that number. This procedure retains additivity of variables (for example, the sum of all income sources still aggregates to the total income) and preserves means of estimated variables. Multiplicative transformation also guarantees that the blurring procedure affects the logarithms of variables in an easy to understand way. In this version of the paper, blurring is ignored and results are discussed as if the actual data was observed, accounting for this issue is work in progress.

rate option was available for individuals who were already conducting business activity. To take advantage of this way of taxation, an individual had to inform appropriate tax office about their choice with a statement by January 20th. The option was also available for new businesses starting in 2004. Those who intended to provide services to their last-year employers, could not choose this form of taxation. The choice made by taxpayer was effective in subsequent years, unless revoked by the taxpayer by informing the appropriate tax office.

A taxpayer who had both business and other types of income and who chose to elect a flat-tax regime, would have to file two (or more) separate tax forms corresponding to different types of income, with taxation of business income and taxes imposed on other types of income computed independently.

Taxation of business income in Poland depends on the organizational form of the business. Sole proprietorships and partnerships without limited liability are pass through entities with all income allocated to owners. Partnerships with limited liability and corporations are subject to the corporate income tax (CIT). The CIT rate was 28% in 2002, it was reduced to 27% in 2003 and subsequently reduced to 19% in 2004 (at which level it stayed since). An owner of a firm that is subject to the CIT does not receive business income that could be taxed using the flat tax.

Capital income, including dividends from firms subject to CIT, is subject to a flat 19% rate and is taxed separately from other types of income (the tax was introduced in 2001). Hence, opting for a standard limited liability structure closes the option of taking advantage of the flat tax and exposes income to double taxation through both CIT and capital income tax. Nevertheless, reductions in the CIT rate in 2004 should lead to a reduction in business income reported on individual income tax returns and bias against finding an effect of the reform.

The tax law appears to link business income associated with limited liability with taxation under CIT, seemingly implying that only income from businesses that are not accorded limited liability can be subject to the flat tax. In practice, this is not the case though. Polish law allows for a hybrid form of an organizational structure called “spółka komandytowa.” This type of structure requires that some partners have limited liability and some do not. Critically for tax purposes, it acts as a pass-through entity, i.e. there is no tax on the partnership level and instead income is allocated and taxed at the partners’ level. Income of an individual who is a limited liability partner in a firm of that kind can be still taxed using the flat tax schedule. Furthermore, the full liability partner can be another firm, for example a limited liability partnership. The full liability partner can hold a minor stake in the business (e.g., 1%). Hence, this kind of structure effectively allows for limited liability (if the full liability partner has limited liability itself) with majority of income being subject

to personal income tax as business income, in particular allowing for the flat tax election.⁵

Choosing a flat tax rate has some important costs. It eliminates joint taxation with the spouse and preferential taxation for lonely parents. It also eliminates tax preferences other than deduction of contributions for social and health insurance (unless these they were included as costs of business activity). Opting for the fixed rate eliminated the possibility of claiming the otherwise universal nonrefundable tax credit. These taxpayers were could not longer benefit from continued deductions obtained in previous years such as construction expenses and student employment deductions as well as special privileges in special economic zones).

Some changes were made in the catalogue of exemptions and deduction from tax, effective on January 1, 2004...

In May of 2004, Poland joined European Union... effect on business income...

To summarize the incentives for switching to a flat tax regime, the reform introduced in 2004 involved trade-offs. It reduced the marginal tax rates from as much as 40% to 19% but did so at the cost of eliminating tax preferences. Hence, individuals who would otherwise be subject to the lowest 19% tax rate under the regular income tax, have no incentive to opt for the flat tax treatment. Those in higher tax brackets may or may not choose to do so depending on their individual circumstances. Elimination of the universal tax credit and joint filing have inframarginal effects for high income individuals (they correspond to, bounded from above, tax savings on income subject to lower marginal tax rates due to these provisions) and for high enough incomes the reduction in marginal tax rate dominates so that flat tax schedule becomes more attractive. While various kinds of tax preferences are important for taxpayers in general, all of them are either capped or small enough so that they do not affect the conclusion that sufficiently high income taxpayers clearly benefit from shifting to a flat tax schedule even assuming no behavioral response.

⁵Since the early 1990s, there have been two additional ways of taxing businesses called *karta podatkowa* (tax card) and *ryczałt* (presumptive tax) that were fairly limited in their reach and applied to very small businesses of particular kinds specified by the law. The “*tax card*” is essentially a lump-sum tax in the amount specified by the local tax authorities. *Ryzałt* is a proportional tax applicable to revenue from certain types of business activity. The rate depends on the type of business. This type of taxation does not allow for deducting costs or for taking advantage of any deductions (*need a bit more discussion, it is in the data but small and with no evidence of response in 2004*).

4 Effect of the reform on business activity and taxable income - descriptive evidence

4.1 Summary statistics

Table 1 contains basic summary statistics. The number of individuals varies very slightly over time. The data shows an upward trend in wages, business income, gross income, taxable income and tax liability, and a flat pattern of deductions. Perhaps the most striking is the growth in reported business income that increased by over 30% between 2003 and 2004, and another 10% in 2005. This is consistent with the reform having an effect on reported business income.

The second panel contains information about those filing as single. There is an increase in the number of individuals who are single filers, again between 2003 and 2004. Note that married individuals who switch to a flat tax schedule, no longer file jointly resulting in additional single tax returns. Consistently with the flat tax schedule having an impact, there is a clear increase in the level of business income reported. This increase in business income is responsible for most of the growth in gross and taxable income as well.

The following two panels show information for individuals who file jointly: both those who were selected in the sample and their spouses. Characteristics of both groups are very similar, as expected, because the sampled individuals are randomly selected. Correspondingly to what was evident for those filing as single, the number of married individuals and their business income drops after 2003, although the increase in wages continues. On balance, gross and taxable income for that group are relatively flat over the period.

Panels 5 and 6, split couples along the income level showing separately summary statistics for the higher and the lower income spouse. There is large disparity in incomes of spouses, with average for higher earnings spouse three times greater than income of lower earnings spouses. Business income is heavily concentrated among higher earning spouses and shows familiar decline after 2003. Lower earning spouses receive a disproportionate share of their income from sources other than wages or business.

The final two panels show summary statistics for a subset of individuals who are present in the data for the full four years. While this is no longer a representative sample of the full population, it has the advantage of being free of compositional changes from one year to another. About 80% of individuals are observed every year. They have higher wages and business income than those who are not filing regularly and show similar temporal pattern as the overall sample with a discrete jump in reported business income in 2004. In the final panel of Table 1, we show summary statistics for those observed in all four years who have

ever filed a joint tax return. Because we observe marriage directly only if a joint return is filed and joint returns may not be filed by some individuals after 2004 due to relying on a flat tax schedule, this is an alternative way of focusing on a stable sample of those who are with high likelihood married. As expected, married individuals have higher income on average and now show the same dramatic growth in business income between 2003 and 2004. There is suggestive evidence that business income has increased between 2003 and 2004 and that this effect is associated with the decline in joint returns and an increase in single returns.

Table 2 provides further background statistics by cutting the data into three categories based on the level of taxable income. Taxable income categories correspond to the thresholds in the tax schedule, although this is not a direct match to the progressive code: data is aggregated across all different tax returns including flat tax, capital income, tax card and *ryczakt*. For married individuals, taxable income is defined here as the average of taxable incomes of the two spouses to approximate the actual tax treatment. There is no evidence of any significant changes in the structure of incomes in the lowest bracket. There is however clear evidence of a very large decline in the average business income in the intermediate bracket. The number of individuals who are in the second bracket increases. Most interestingly, business income reported in the highest bracket increases by 50% and the number of individuals in that category also increases by about 50%. At the same time, the average wage in that bracket actually declines. This can correspond to conversion of wages into business income but it may also be an artifact of the changing composition of that group. Reliance on deductions among the highest income taxpayers drops precipitously, again consistently with the effect being driven by flat-rate schedule that eliminates most deductions. Taken together, these patterns suggest important shifts in the composition of incomes and location of individuals in high income tax brackets.

Overall this simple descriptive evidence suggests that there were significant changes in the structure of tax returns between 2003 and 2004. The overall reported business income has increased and the prevalence of single filing also increased. Business income reported on joint tax returns decreased very significantly, suggesting that the substantial chunk of income previously subject to the progressive tax shifted to the flat tax. Furthermore, these changes occurred only in the high income part of the distribution.

Figure 1 shows the likelihood of choosing the flat tax in 2004 and 2005 conditional 2002 income level, with the two vertical lines corresponding to the brackets of the progressive income tax schedule. Figure 2 shows the same information for the subset of individuals who claimed business income in all years between 2002 and 2005. As expected, reliance on the flat tax does not begin until the first income threshold is crossed and taxpayers are in the 30% marginal tax rate — this is natural as benefitting from the flat tax requires being in

one of the higher tax bracket and income is significantly correlated across years. Reliance on the flat tax increases quickly afterwards. In particular, for high income business owners it is close to uniform. Figures 3 and 4 show similar information but putting rank in various years on the horizontal axis. The figure for the full distribution is restricted to the top decile and it makes it clear that the flat tax is very high income phenomena: over 40% of 2005 filers in the top percentile rely on this type of taxation while the corresponding number even as close as the the 97th percentile is below 10%. Again, limiting the sample to business owners reveals though that this is not a niche tax treatment for that group as the tax is relied upon by a broad swath of that group.

Table 3 shows basic variables for taxpayers who *chose* to take advantage of the flat tax schedule in 2004 and 2005, as well as those who only did so in one of those years. Approximately 12500 out of 1.4 million regular filers chose to file a flat tax return in 2004 and the additional 3600 did so in 2005. While, this is only about 1% of all taxpayers, these are predominantly very high income taxpayers. The average gross income of those who filed form PIT-36L in both 2004 and 2005, was already 120000zł in 2003 — well above the threshold for the top tax bracket although below the average income in that bracket. The average gross income in 2005 was over 200000zł and about equal to the average in the top bracket. Between 2003 and 2004, business income of those taxpayers increase by almost 60% and it increased by another 8% in 2005. A similar jump but from a lower basis is also evident between 2004 and 2005 for those who chose to file according to the flat tax schedule in 2005 only. Taxpayers who were on the flat tax schedule in 2004 only did not experience much of an increase between 2003 and 2004 and actually show a decline in their incomes in 2005.

These results are suggestive of the reform having an effect on reporting but they fall short of establishing causality. It is clear that business income for taxpayers who chose to file according to the flat tax schedule started increasing even before the reform while their wage income had already been declining. A taxpayers who are on an increasing income trajectory may be more likely to have higher income in the future and therefore more likely take advantage of new provisions that are beneficial to taxpayers with high income. This effect produces an association between taking advantage of the reform and income growth but it is not a causal relationship.

In Table 4, we eliminate one source of selection into the flat tax by focusing on individuals who owned a business throughout the whole period. 22% of this group switched to a flat tax in 2004 and additional 6% did so in 2005. The same temporal pattern of reported business income as before is evident for the whole group, suggesting that selection effects are not driving it (although this is still a selected sample: these are individuals who were able to stay in business throughout the period).

The bottom panel of the table shows some information about the spouses. The middle panel shows information based on joint tax returns. Because taxpayers who are relying on a flat tax can no longer claim jointly (unless they have other sources of income), the spousal variables after 2003 are based only on those who continued to file jointly. To address this issue, the following panel uses an alternative definition of the spousal variable. Instead of relying on the current spouse, the spouse is defined as a person with whom a joint tax return was filed in both 2002 and 2003, regardless of whether a joint return was filed in 2004 or 2005. Business income reported by spouses has increased significantly as well and so did wage income. This suggests that, as a first pass, the bulk of the response did not have to do with reallocation of income between spouses. It is also interesting to point out here that the election of a flat tax may change the marginal tax rate face by the spouse (especially, lower income spouse) and affect the behavior of the spouse directly through that channel.

Figure 5 shows composition of the top groups in the income distribution among business and non-business owners between 2002-2005. A striking feature of that figure is the composition of the top percentile — precisely where the flat tax is widespread — has shifted significantly toward business owners between 2003 and 2004. This is again suggestive of large increases in income for business owners although it leaves open the possibility of conversion from other types of income to business type. It also suggests that individuals are re-ranked following the reform, with business owners shifting higher up so that the composition of the top group potentially changes as the result of the reform. This is important, as the repeated cross-sectional analysis advocated by Saez et al. (2009) requires that there is no rank reversal. Much of the following analysis will rely on a subsample of individuals who consistently owned business income to eliminate that margin. Taxpayers may choose to start a business when incentives for reporting business income improve. However, the number of individuals actually reporting business income slightly declined between 2003 and 2004.⁶ While this is not a definitive evidence, it suggests that the apparent strong responses discussed before do not have their source at this margin.

One way of getting further insight into the effect of the reform on gross income is to actually take a look at changes in the income distribution during that period. Figure 6 shows the distribution of income between 2002 and 2005. The bulk of the distribution is located far below the first threshold and while it appears to have been changing somewhat, it is unlikely to be related to the reform (*multiple modes, pensions, minimum wage?*). More interestingly, distributions for 2004 and 2005 appear to lie a little bit above those for 2002 and 2003, starting a little bit below the first threshold. Figure 7 zooms in on the population

⁶The number of individuals reporting business income in the dataset in 2002-2005 was 72883, 72206, 71518 and 71072 respectively.

of (consistent) business owners and provides a stronger evidence of the effect consistent with the reform having an impact. There is a decline in 2004-2005 in the mass of individuals below and around the first threshold and a sizable increase in the number of individuals well above the second threshold. The mode of all the distributions is located close to the first income tax threshold, consistent with the kink of the tax schedule having an effect on reported income. The magnitude of that mode declines after 2003. A potential caveat to the interpretation of this figure is that the numbers are nominal. On Figure 8, income is adjusted for inflation and GDP growth. The price level increased 6.3% between 2002 and 2005 and GDP has increased by 12.5% (3.8% in 2003, 5% in 2004 and 3.2% in 2005). This modification eliminates the impression of movements in the distribution well below the first threshold but still indicates a significant shift of the mass roughly from the second tax bracket to the top of the distribution where the progressive tax schedule imposes the marginal rate of 40%.

Figures 9 and 10 illustrate that changes in the income distribution are indeed associated with flat tax taxpayers: they show the distribution of income among (consistent) business owners by whether they are on the flat tax schedule in 2005. There are minor movements with no obvious temporal pattern of the income distribution for those who chose not to use flat tax by 2005 but the income distribution moves significantly and in a way very consistent with the reform for those who chose to use flat tax in 2005.⁷

5 Estimating the causal effect of the reform

5.1 Repeated cross-section

A simple approach to estimating the effect of the reform, advocated by Saez (2004) and Saez et al. (2009) relies on comparing the same slices of income distribution across years, in effect a repeated cross-sectional analysis. Figure 11 shows the change in gross income for subsequent pairs of years between 2002 and 2005 by percentile of the income distribution (shown for the top decile). There is striking pattern of an increase in incomes between 2003 and 2004 at the very top of the distribution, with no major variation in 2002-2003 and 2004-2005. This is of course nicely associated with the pattern of reliance on the flat tax evidenced on Figure 3. Digging a bit deeper, there may be a little bit of evidence of a slower growth in incomes toward the top between 2002-03 and faster growth between 2004-05, possibly consistent with delaying 2003 income until 2004 and the effects of the reform continuing to phase in also in 2005. Figure 12 confirms these finding for consistent business owners only,

⁷Interestingly, the modes of the two distributions appear to coincide very nicely with the kinks in the progressive income tax schedule.

thereby eliminating the effect of compositional change and relaxing the effect of occupational changes. Finally, Figure 13 reveals that the effect are there even when one considers joint income of both spouses and thus cannot be explained by shifting of income between spouses.

The key and natural question to ask is about the consequences of these responses for tax revenue. This is investigated on Figures 14 and 15. The growth in revenue in 2003-04 and 2004-2005 is higher than in 2002-2003 but the effect is nonlinear: revenue increase is much slower for the top percentile and, when focusing business owners, the revenue actually declines at the high end. In fact, with the marginal tax rate declining from 40% to 19%, income of individuals far into the top bracket would have to double to compensate for lost revenue and responses of income level identified before are not nearly as large. On the other hand, lower down the distribution where marginal tax rates fall by less and inframarginal effects are more important, one may expect revenue increases even with lower responses and that indeed appears to be the case. The overall effect of the reform needs to combine these different effects... Figure 16 shows the effect on the joint tax liability of a couple and suggests similar pattern of responses but tilted toward more revenue, suggesting that shifts toward flat tax may in part come at the cost of the higher tax liability for the spouse.

Figure 17 shows the effect on business income rather gross income and, not surprisingly, reveals effects that are similar to those on the overall income. The following two figures, 18 and 19 decompose the response into response of revenue and costs. Interestingly, the effect on revenue is not obvious, with the exception of the very top of the distribution. On the other hand, the growth rate of cost appears to decline after 2002-03. Understanding these patterns requires more work but suggests that while reporting higher revenue is one possible channel, reducing reported costs may be in fact a more important channel.

There are three limitations of this approach. First, converting these estimates into the precise effect of the statutory tax changes is not straightforward. Second, the approach compares different income groups and hence is subject to potential (albeit perhaps not terribly strong in this particular case) criticism that it confounds changes in income distribution with the effect of policy. Third, the key assumption here is that there is no rank-reversal that is caused by the reform, i.e. that there are no groups that permanently shift in the income distribution. This assumption is dubious as it is precisely business owners that are affected by the policy change and, in fact, as the discussion in the previous section strongly suggests, their representation at the very top of the distribution significantly increases.⁸ Even among the group of business owners, it is natural to expect that the reform likely had heterogenous effect on their behavior, so that the assumption of no rank-reversal appears very strong. For

⁸This concern of course is alleviated if one considers only business owners as the sample of interest, but the other two problems remain.

example, if one of the sources of response has to do with reduced tax avoidance or shifts from informal economy, one would suspect that the strength of this effect varies very much with the nature of business activity and preferences of the business owner.

5.2 Panel

We begin exploiting the panel information by showing changes in income growth rates by the initial (2002) gross income. Figure 20 shows the growth rate of incomes by the initial (2002) level of gross income. The most striking feature is the decline between 2002-03: this is well-known mean-reversion of incomes that is unrelated to the tax reform. It is also one of the main complications in the work on taxable income elasticity. It is clear from this graph, that this effect is non-linear and hence unlikely to be controlled for using just a linear term, thereby illustrating why controlling for nonlinearity via splines advocated by Gruber and Saez (2002) makes a significant difference in practice when estimating taxable income elasticities. On the other hand, growth rates for 2003-2004 and 2004-05 no longer show a significant income gradient suggesting that mean-reversion need no longer be an issue once we condition on data at least a year apart. As expected given previous analysis, there is a visible increase in the growth rate in 2003-04 for people with sufficiently high incomes. Figure 21 contains analogous results for (consistent) business owners and shows similar patterns. It is also worth noting that the mean-reversion pattern in the 2002-03 data has a different shape than for the whole population. That suggests that imposing the same mean reversion controls for business and non-business owners may not control for these effects appropriately.

In order to estimate the effect of the reform formally, we exploit differences in its impact on various categories of individuals. Conceptually, we will estimate specifications of the form:

$$\Delta \ln(y_{it}) = \alpha \Delta L_{it} + \beta X_{it} + \Delta \varepsilon_{it}$$

where y_{it} is the variable of interest, for example gross income or taxable income, L_{it} is a dummy variable for being subject to the flat tax regime and X_{it} is the set of controls, and the equation is already expressed in the first-differenced form. This is analogous to specifications estimated elsewhere in the taxable income literature with the dummy for being subject to the new tax regime replacing the marginal tax rate. The key variable is L_{it} and it is of course endogenous. We will pursue simple IV strategy based on constructing an indicator for a groups that is likely to be take advantage of the reform and that is arguably pre-determined. We will usually estimate this specification in first-differenced form. The error term in this specification ε_{it} is in general complicated and reflects variety of factors that are not modeled here. In particular, it contains individual-specific but unobservable characteristics that are

likely to influence the desire to take advantage of the reform (such as for example, risk aversion). Including individual fixed effect or first-differencing is one possible approach for removing this source of bias. The error term is also likely to reflect individual earnings dynamics and is likely to be autocorrelated. This type of error is likely to be correlated with the likelihood of taking advantage of the reform: for example, individuals who have temporarily high income may take advantage of the reform introducing correlation between the variable of interest and the instrument.

We seek instruments that would influence the likelihood of taking advantage of the flat tax regime while not being related to the error term ε_{it} . We will rely on pre-determined variables as of 2002. In the first strategy, we will use as an instrument owning a business in 2002 as an instrument. It is natural to expect that owning a business prior to the reform would influence the likelihood of taking advantage of the flat tax. Being a business owner is an endogenous decision and factors that influence that decision are likely to enter the error in the income equation, ε_{it} . Many of such factors can be reasonably expected to be constant characteristics of an individual and hence eliminated by first-differencing. However, owning a business is a decision that may change over time and may influence earnings dynamics hence introducing a correlation between owning a business and income changes in the future. Following taxable income literature (Moffitt and Wilhelm, 2000; Gruber and Saez, 2002; Kopczuk, 2005) that stressed the importance of controlling for mean reversion and other sources of transitory income dynamics, we will include flexible function of the log of gross income (piecewise linear splines) to proxy for such transitory effects. While the literature sometimes makes a distinction between controlling for the transitory dynamics and overall trends in earnings inequality, the approaches that have been proposed require multiple lags of income to control for it and given the short span of the panel are not feasible here (although a limited attempt will be discussed later).

Conceptually, this approach corresponds to a very simple difference-in-difference strategy where individuals who owned a business in 2002 are considered a treatment group and those who did not are considered a control group. This is most easily visible if we consider a three-year difference where a change in income between 2005 and 2002 is used as the left-hand side variable. In a reduced-form regression, this change would be regressed on owning a business in 2002, corresponding to a difference-in-difference estimate of the “intent to treat” effect. Switching to a flat tax is the actual realized treatment and the IV strategy attempts to estimate the effect of this treatment. Using the presence of a business in pre-period as an instrument amounts to using other types of income as a control for business income.

The first two panels of tables 5 and 6 rely on this instrument and provide estimates of the effect on gross income and tax liability. The effects on gross income are very precise and

indicate a 20% increase in the level of income occurring in 2003-04. However, the effects on tax liability are odd and indicate a substantial increase but occurring mostly in 2002-03 (ie., pre-reform). Figure 22 illustrates the mechanics of this approach. It shows the gross income change between 2002 and 2005 and probability of filing for the flat tax in 2005 as a function of gross income. The strategy works by comparing the parts of the distribution where there is a sizable difference in flat tax filing to those where the difference is small. The maintained assumption is that there should be difference if not for the flat tax — in that case, the flexible function of gross income can control for non-tax related variation in growth rates across distribution. A simple inspection of the figure casts doubt on this assumption. Controlling for these differences is not straightforward as the group indicator needs to be excluded in order to be used as an instrument.

The other instrumental variables strategies that we will pursue rely on characteristics of the spouse. First, we will use a dummy for the spouse being in one of the higher tax brackets. This strategy leads to unrealistic estimates (the estimate of about 2.5 corresponding to income increasing by a factor of 12...) for reasons that are again easy to explain graphically: as shown on Figure 23, there is a big difference in the rate of income growth between the groups throughout the distribution that is therefore correlated with the instrument but unrelated to the treatment. The final strategy relies on the spouse owning a business. If that is the case, one might expect that the likelihood of switching to the flat tax may be higher both due to lost averaging possibilities if the spouse switches and because of higher likelihood of exposure to this form of taxation. It turns out that there is a strong first stage but similar problems as before persist with sizable and wrongly sized effects on tax liability before the reform and apparent growth in incomes throughout the period, not just when reform took place.

One conclusion to be drawn from this analysis is that the inability to appropriately control for differential mean reversion effects between control and treatment groups is an issue. This is actually not terribly surprising as the approach imposes the same shape of earnings process for the treatment groups (which by construction should have more business owners) and control groups (titled toward other types of incomes) and it is not realistic to expect that this could be the case. A way around it is to pursue analysis on a more homogenous group where the assumptions about homogeneity of the earnings process are more likely to hold.

In what follows, I will pursue the analogous approach using the subsample of individuals who reported business income in all four years. I will use the instruments discussed before (with the exception of owning a business as it no longer makes sense) and one additional strategy discussed below.

Table 7 contains the results that are based on using spouse in the high tax bracket as the instrument. Before analyzing these results, it is worthwhile to investigate the effect graphically as before. This is illustrated on Figures 24-28 that show growth rate changes between 2002-05, 2002-03, 2003-05, 2003-04 and 2004-05 respectively. It is comforting to see that the income gradient is in fact very similar for the two groups and that the difference between income growth in 2002-05 occurs primarily where there is also an effect on flat tax filing. It is also interesting to observe that the sizable growth in income well into the top bracket *is not* the source of identification as it occurs past the range of the incomes where treatment and control groups have different propensities to rely on the flat tax. Therefore, the identification here stems mostly from groups further down the income distribution. Generally speaking, the conclusion that the instrument is associated with flat tax filing and higher growth rates holds for subperiods as well. Hence, it appears that the necessary conditions for this instrument to be valid are likely to hold.

Turning to estimates in Table 7, one can see that they paint a picture that is broadly consistent with repeated cross-sectional evidence discussed before. The estimate of the overall effect of the reform is 0.397 or 48%: being subject to the flat tax leads to increase in income by 50%. This effect is concentrated in 2003-04 and continues somewhat into 2004-05. Log business incomes are estimated to increase by 0.668 (growth rate of 95%), again concentrated in 2003-04. The effect appears to stem mostly from revenue rather than costs, although the costs start increasing in 2004-05. The effects on tax liability remain puzzling as they indicate a decline in 2002-03 (which is plausible but inconsistent with the lack of direct evidence on the level of income). The final panel contains sensitivity analysis. Using linear log-income effect leads to higher but not much higher estimates, this is consistent with the income gradient on Figure 24 being not far from linear. Controlling for spousal income appears to kill identification and eliminate the first stage. Finally, I try a simple approach to control for both transitory effects and potential distributional changes by focusing on 2003-05 change and simultaneously including splines in 2002 incomes (to control for inequality changes) and for the income change between 2002-03 (to control for transitory effects). Adding this extra control makes little difference to the estimates.

Table 8 shows estimates based on using the indicator for the spouse owning a business as an instrument. The results for gross income, business income, cost and revenue are very similar as before. This alternative approach makes a significant difference for tax liability that no longer reveals any effects.

Finally, Table 9 uses a different instrument that attempts to take a better account of joint filing possibilities. Couples who have similar incomes benefit less from income splitting; in the extreme if incomes are the same there is no benefit. I define a dummy for incomes

being close if ratio of the sampled taxpayers income to that of the spouse is between 0.5 and 1.5 and use that variable as an instrument. Again, this appears to be a reasonably strong instrument and comfortingly leads to broadly similar results as the other two strategies. The effect of the reform on gross income is estimated at 0.42 or 52%, with similar effect for business income. This approach fails to identify revenue or costs as the source of response and paints a somewhat different pattern of tax liability response: tax revenue stays constant but that corresponds to a fall in 2002-03 and an increase in 2003-04, potentially consistent with income shifting and also consistent with the temporal pattern of gross income changes that this approach appears to reveal.

Nonlinearity of the effects on tax liability alluded to in the cross-sectional analysis is a potential reason for why different instruments generate different estimates of the effect of this variable — they may act in different places.

6 Conclusions

We pursued the approach introduced by Feldstein (1995) who focused on estimating the responsiveness of taxable income to changes in the tax rates to analyze the effect of the 2004 Polish flat tax reform. This context is a natural candidate for this kind of study and holds promise to deliver results that are of greater relevance for lower income countries than those produced by the literature on the elasticity of taxable income to date. Studies that are relied on the US data initially found large responsiveness (Lindsey, 1987; Feldstein, 1995; Auten and Carroll, 1999), but more recent work in this area has shown that these results were due to insufficient controlling for non-tax related income distribution widening and mean reversion so that the actual elasticities are quite moderate (Gruber and Saez, 2002; Kopczuk, 2005). While findings for other countries are broadly consistent with those for the US (Sillamaa and Veall, 2001; Aarbu and Thoreson, 2001; Bianchi et al., 2001), there are enough differences to support the argument of Slemrod and Kopczuk (2002) that taxable income elasticities are not in fact primitive parameters having its source in preferences and technology but they also reflect administrative aspects of the tax code. For that reason, analysis in additional countries and additional contexts is of interest not only in those particular places but it helps in understanding the nature and determinants of such responses more generally.

The Polish 2004 reform introduced a low-rate broad-base option for reporting income by business owners. We found that there was a dramatic increase in the amount of reported business income that occurred as a result. This increase appears driven by the existing business owners who report more income on their tax returns. It is still an open question, awaiting more thorough analysis, to determine the nature of this response: does it reflect

business activity or increased compliance. There are indications that both might be at play but the effects are large enough to be unlikely to stem from real activity alone. In fact, response of business revenue appears to be generally smaller than that of overall income, suggesting that business owners report higher margins than before. Evidence on the effect on tax liability is somewhat inconclusive and points to nonlinear effects of the reform: decreases in revenue at the top of the distribution and increases further down, consistent the combined effect of the tax cuts and elimination of inframarginal preferences.

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Table 1: Summary statistics

| Variable (1) | 2002 (2) | 2003 (3) | 2004 (4) | 2005 (5) |
|---|-------------|-------------|-------------|-------------|
| Number of observations | 1659974 | 1646963 | 1639355 | 1639028 |
| Wages | 8872 | 8880 | 9161 | 9691 |
| Business income | 1555 | 1604 | 2135 | 2371 |
| Deductions | 106 | 109 | 88 | 129 |
| Gross income | 15792 | 16015 | 17050 | 17969 |
| Taxable income | 13983 | 14207 | 15366 | 16189 |
| Tax liability | 2437 | 2486 | 2617 | 2796 |
| Number of flat taxpayers | 0 | 0 | 13108 | 16843 |
| <i>Filing independently</i> | | | | |
| Number of observations | 924545 | 919220 | 930117 | 930074 |
| Wages | 6022 | 6014 | 6332 | 6757 |
| Business income | 839 | 869 | 2853 | 3333 |
| Deductions | 79 | 82 | 72 | 100 |
| Gross income | 12949 | 13107 | 15596 | 16651 |
| Taxable income | 11673 | 11834 | 14401 | 15355 |
| Tax liability | 1978 | 2018 | 2464 | 2669 |
| <i>Filing jointly</i> | | | | |
| <i>Sampled individuals</i> | | | | |
| Number of observations | 735429 | 727743 | 709238 | 708954 |
| Wages | 12455 | 12501 | 12870 | 13541 |
| Business income | 2454 | 2531 | 1193 | 1109 |
| Deductions | 140 | 143 | 110 | 167 |
| Gross income | 19366 | 19687 | 18956 | 19699 |
| Taxable income | 16887 | 17205 | 16631 | 17284 |
| Tax liability | 3015 | 3078 | 2818 | 2962 |
| <i>Spouses of sampled individuals</i> | | | | |
| Wages | 12296 | 12296 | 12653 | 13232 |
| Business income | 2361 | 2425 | 1151 | 1061 |
| Deductions | 142 | 144 | 111 | 167 |
| Gross income | 19233 | 19411 | 18739 | 19400 |
| Taxable income | 16782 | 16962 | 16451 | 17006 |
| Tax liability | 2997 | 3005 | 2768 | 2888 |
| <i>Higher income spouses</i> | | | | |
| Wages | 19400 | 19381 | 19894 | 20795 |
| Business income | 4286 | 4417 | 2139 | 1989 |
| Deductions | 249 | 251 | 191 | 293 |
| Gross income | 28868 | 29096 | 27731 | 28691 |
| Taxable income | 25257 | 25498 | 24385 | 25220 |
| Tax liability | 4546 | 4579 | 4121 | 4309 |
| <i>Lower income spouses</i> | | | | |
| Wages | 5517 | 5612 | 5847 | 6287 |
| Business income | 620 | 635 | 240 | 219 |
| Deductions | 35 | 36 | 28 | 40 |
| Gross income | 9966 | 10253 | 10173 | 10695 |
| Taxable income | 8618 | 8888 | 8884 | 9323 |
| Tax liability | 1526 | 1567 | 1514 | 1608 |
| <i>Always observed individuals</i> | | | | |
| Number of observations | 1395355 | 1395355 | 1395355 | 1395355 |
| Wages | 9567 | 9768 | 10116 | 10521 |
| Business income | 1711 | 1799 | 2420 | 2694 |
| Deductions | 111 | 118 | 97 | 146 |
| Gross income | 16778 | 17411 | 18737 | 19706 |
| Taxable income | 14822 | 15420 | 16884 | 17759 |
| Tax liability | 2600 | 2719 | 2905 | 3095 |
| <i>Always observed ever married individuals</i> | | | | |
| Number of observations | 785416 | 785416 | 785416 | 785416 |
| Wages | 12252 | 12376 | 12698 | 13116 |
| Business income | 2276 | 2395 | 3145 | 3493 |
| Deductions | 129 | 136 | 106 | 165 |
| Gross income | 19101 | 19667 | 21130 | 22211 |
| Taxable income | 16648 | 17199 | 18792 | 19816 |
| Tax liability | 2951 | 3064 | 3244 | 3459 |

Table 2: Summary statistics by taxable income categories

| Variable | 2002 | 2003 | 2004 | 2005 |
|---|---------|---------|---------|---------|
| (1) | (2) | (3) | (4) | (5) |
| <i>Taxable income not greater than 37024</i> | | | | |
| Number of observations | 1591678 | 1575739 | 1560880 | 1550297 |
| Wages | 7403 | 7329 | 7415 | 7674 |
| Business income | 607 | 611 | 528 | 524 |
| Deductions | 87 | 90 | 88 | 123 |
| Gross income | 13199 | 13318 | 13575 | 13973 |
| Taxable income | 11645 | 11778 | 12075 | 12395 |
| Tax liability | 1798 | 1822 | 1874 | 1940 |
| <i>Taxable income \in (37024, 74048]</i> | | | | |
| Number of observations | 54910 | 57315 | 61493 | 68960 |
| Wages | 37994 | 38018 | 39876 | 41093 |
| Business income | 10420 | 10093 | 7846 | 7284 |
| Deductions | 228 | 218 | 74 | 208 |
| Gross income | 55526 | 55312 | 54735 | 55116 |
| Taxable income | 48521 | 48395 | 48183 | 48263 |
| Tax liability | 9924 | 9890 | 9704 | 9726 |
| <i>Taxable income greater than 74048</i> | | | | |
| Number of observations | 13386 | 13909 | 16982 | 19771 |
| Wages | 64161 | 64595 | 58330 | 58338 |
| Business income | 77808 | 79024 | 129131 | 130031 |
| Deductions | 1878 | 1779 | 171 | 335 |
| Gross income | 161110 | 159540 | 199958 | 201745 |
| Taxable income | 150250 | 148552 | 199028 | 201856 |
| Tax liability | 47683 | 47179 | 45231 | 45763 |

Table 3: Flat tax taxpayers

| (1) Variable | 2002 (2) | 2003 (3) | 2004 (4) | 2005 (5) |
|---|-------------|-------------|-------------|-------------|
| <i>Always observed individuals on flat tax in 2004 and 2005</i> | | | | |
| Number of observations | 11869 | 11869 | 11869 | 11869 |
| Wages | 8032 | 6998 | 6187 | 6517 |
| Business income | 104827 | 116347 | 180971 | 190412 |
| Deductions | 1608 | 1644 | 27 | 61 |
| Gross income | 119786 | 128743 | 191587 | 204612 |
| Taxable income | 111215 | 120453 | 186582 | 204188 |
| Tax liability | 33543 | 36550 | 35912 | 39958 |
| <i>Always observed individuals on flat tax only in 2005</i> | | | | |
| Number of observations | 4475 | 4475 | 4475 | 4475 |
| Wages | 12301 | 11856 | 10310 | 8261 |
| Business income | 27316 | 31769 | 48836 | 85387 |
| Deductions | 377 | 365 | 106 | 61 |
| Gross income | 44441 | 48529 | 64293 | 98063 |
| Taxable income | 39345 | 43108 | 58957 | 93128 |
| Tax liability | 9355 | 10380 | 15307 | 18212 |
| <i>Always observed individuals on flat tax only in 2004</i> | | | | |
| Number of observations | 781 | 781 | 781 | 781 |
| Wages | 11221 | 9648 | 10427 | 14299 |
| Business income | 44782 | 47822 | 49679 | 16761 |
| Deductions | 614 | 430 | 6 | 129 |
| Gross income | 61300 | 62670 | 65309 | 38247 |
| Taxable income | 55821 | 57116 | 61271 | 33857 |
| Tax liability | 14783 | 15376 | 12229 | 9576 |

Table 4: Individuals reporting business income for all years

| Variable | 2002 | 2003 | 2004 | 2005 |
|--|-------|-------|-------|-------|
| (1) | (2) | (3) | (4) | (5) |
| Number of observations | 42653 | 42653 | 42653 | 42653 |
| Wages | 6395 | 6117 | 6328 | 6778 |
| Business income | 45818 | 49016 | 64803 | 70225 |
| Deductions | 566 | 576 | 60 | 122 |
| Gross income | 55522 | 58687 | 74871 | 81024 |
| Taxable income | 50021 | 53451 | 70852 | 77047 |
| Tax liability | 12436 | 13486 | 13561 | 14742 |
| % on flat tax | 0.00 | 0.00 | 0.22 | 0.28 |
| <i>Spousal variables</i> | | | | |
| Number of observations | 26762 | 26769 | 20437 | 18817 |
| Wages | 11566 | 11706 | 12364 | 13032 |
| Business income | 12869 | 12947 | 5062 | 4602 |
| Deductions | 236 | 254 | 69 | 126 |
| Gross income | 27833 | 28354 | 21221 | 21770 |
| Taxable income | 24475 | 25093 | 18555 | 19082 |
| Tax liability | 5722 | 5926 | 3571 | 3664 |
| <i>Spouse defined based on 2002-2003</i> | | | | |
| Number of observations | 25316 | 25316 | 23993 | 23481 |
| Wages | 11603 | 11844 | 12795 | 13596 |
| Business income | 13012 | 13390 | 17828 | 19655 |
| Deductions | 243 | 265 | 68 | 130 |
| Gross income | 28004 | 28972 | 34651 | 37594 |
| Taxable income | 24608 | 25643 | 31740 | 34652 |
| Tax liability | 5749 | 6088 | 6135 | 6716 |

Table 5: Everyone

| Variable | Coefficient (1) | t-value (2) | Coefficient (3) | t-value (4) | N (5) |
|--|--------------------|----------------|--------------------|----------------|----------|
| | OLS | | IV | | |
| Using owning a business as an instrument | | | | | |
| Gross income | | | | | |
| First stage | | | 0.167*** | 405.664 | 1238348 |
| 2002-2005 | 0.627*** | 125.393 | 0.152*** | 10.337 | 1238348 |
| 2002-2003 | 0.277*** | 74.185 | -0.012 | -1.124 | 1238348 |
| 2003-2004 | 0.282*** | 71.414 | 0.144*** | 12.472 | 1238348 |
| 2004-2005 | 0.068*** | 16.553 | 0.020* | 1.649 | 1238348 |
| Tax liability | | | | | |
| First stage | | | 0.179*** | 413.444 | 1166559 |
| 2002-2005 | 0.571*** | 94.231 | 0.433*** | 25.549 | 1166559 |
| 2002-2003 | 0.341*** | 72.478 | 0.265*** | 20.094 | 1170223 |
| 2003-2004 | 0.188*** | 39.693 | 0.095*** | 7.176 | 1186107 |
| 2004-2005 | 0.041*** | 8.619 | 0.072*** | 5.325 | 1191285 |

Table 6: Married

| Variable | Coefficient (1) | t-value (2) | Coefficient (3) | t-value (4) | N (5) |
|---|--------------------|----------------|--------------------|----------------|----------|
| OLS | | IV | | | |
| Using owning a business as an instrument | | | | | |
| Gross income | | | | | |
| First stage | | | 0.178*** | 276.334 | 495150 |
| 2002-2005 | 0.583*** | 87.762 | 0.191*** | 10.485 | 495150 |
| 2002-2003 | 0.264*** | 55.308 | 0.044*** | 3.395 | 495150 |
| 2003-2004 | 0.270*** | 52.495 | 0.125*** | 8.838 | 495150 |
| 2004-2005 | 0.048*** | 8.942 | 0.022 | 1.488 | 495150 |
| Tax liability | | | | | |
| First stage | | | 0.187*** | 281.258 | 480786 |
| 2002-2005 | 0.549*** | 67.690 | 0.404*** | 18.729 | 480786 |
| 2002-2003 | 0.336*** | 53.611 | 0.280*** | 16.713 | 482507 |
| 2003-2004 | 0.184*** | 28.924 | 0.088*** | 5.212 | 483091 |
| 2004-2005 | 0.027*** | 4.243 | 0.050*** | 2.935 | 482971 |
| Using spouse in high tax bracket as an instrument | | | | | |
| Gross income | | | | | |
| First stage | | | 0.018*** | 33.356 | 474083 |
| 2002-2005 | 0.579*** | 84.280 | 2.526*** | 16.454 | 474083 |
| 2002-2003 | 0.266*** | 53.906 | 0.969*** | 9.299 | 474083 |
| 2003-2004 | 0.271*** | 50.773 | 1.124*** | 9.938 | 474083 |
| 2004-2005 | 0.042*** | 7.503 | 0.433*** | 3.718 | 474083 |
| Tax liability | | | | | |
| First stage | | | 0.017*** | 32.819 | 460540 |
| 2002-2005 | 0.542*** | 64.508 | -0.629*** | -3.545 | 460540 |
| 2002-2003 | 0.337*** | 51.857 | 0.223 | 1.644 | 462186 |
| 2003-2004 | 0.187*** | 28.360 | -0.613*** | -4.385 | 462719 |
| 2004-2005 | 0.018*** | 2.670 | -0.284** | -2.068 | 462590 |
| Using spouse owning a business as an instrument | | | | | |
| Gross income | | | | | |
| First stage | | | 0.074*** | 99.047 | 474083 |
| 2002-2005 | 0.579*** | 84.280 | 0.724*** | 14.989 | 474083 |
| 2002-2003 | 0.266*** | 53.906 | 0.137*** | 3.943 | 474083 |
| 2003-2004 | 0.271*** | 50.773 | 0.426*** | 11.359 | 474083 |
| 2004-2005 | 0.042*** | 7.503 | 0.161*** | 4.089 | 474083 |
| Tax liability | | | | | |
| First stage | | | 0.075*** | 98.813 | 460540 |
| 2002-2005 | 0.542*** | 64.508 | 0.257*** | 4.398 | 460540 |
| 2002-2003 | 0.337*** | 51.857 | 0.286*** | 6.285 | 462186 |
| 2003-2004 | 0.187*** | 28.360 | -0.152*** | -3.286 | 462719 |
| 2004-2005 | 0.018*** | 2.670 | 0.035 | 0.772 | 462590 |

Table 7: Business owners only — using spouse in high tax bracket as an instrument

| Variable | Coefficient (1) | t-value (2) | Coefficient (3) | t-value (4) | N (5) |
|----------------------------|--------------------|----------------|--------------------|----------------|----------|
| | OLS | | IV | | |
| Gross income | | | | | |
| First stage | | | 0.123*** | 21.927 | 25315 |
| 2002-2005 | 0.653*** | 50.415 | 0.397*** | 4.146 | 25315 |
| 2002-2003 | 0.362*** | 37.132 | -0.077 | -1.042 | 25315 |
| 2003-2004 | 0.273*** | 25.039 | 0.324*** | 4.050 | 25315 |
| 2004-2005 | 0.018 | 1.632 | 0.150* | 1.816 | 25315 |
| Business income | | | | | |
| First stage | | | 0.123*** | 21.927 | 25315 |
| 2002-2005 | 0.748*** | 39.497 | 0.668*** | 4.807 | 25315 |
| 2002-2003 | 0.396*** | 27.671 | 0.008 | 0.073 | 25315 |
| 2003-2004 | 0.313*** | 21.144 | 0.418*** | 3.854 | 25315 |
| 2004-2005 | 0.040*** | 2.596 | 0.242** | 2.153 | 25315 |
| Business revenue | | | | | |
| First stage | | | 0.123*** | 21.927 | 25315 |
| 2002-2005 | 0.382*** | 28.195 | 0.296*** | 2.971 | 25315 |
| 2002-2003 | 0.162*** | 19.197 | -0.056 | -0.888 | 25315 |
| 2003-2004 | 0.163*** | 21.880 | 0.159*** | 2.915 | 25315 |
| 2004-2005 | 0.057*** | 6.778 | 0.192*** | 3.072 | 25315 |
| Business cost | | | | | |
| First stage | | | 0.123*** | 21.876 | 25062 |
| 2002-2005 | 0.269*** | 17.454 | 0.198* | 1.757 | 25062 |
| 2002-2003 | 0.108*** | 10.973 | -0.073 | -1.007 | 25114 |
| 2003-2004 | 0.116*** | 13.636 | 0.078 | 1.257 | 25128 |
| 2004-2005 | 0.047*** | 4.961 | 0.218*** | 3.132 | 25090 |
| Tax liability | | | | | |
| First stage | | | 0.125*** | 21.686 | 24071 |
| 2002-2005 | 0.700*** | 42.595 | -0.411*** | -3.170 | 24071 |
| 2002-2003 | 0.479*** | 35.336 | -0.284*** | -2.699 | 24149 |
| 2003-2004 | 0.234*** | 16.487 | -0.196* | -1.838 | 24198 |
| 2004-2005 | -0.022 | -1.634 | 0.032 | 0.318 | 24237 |
| Sensitivity (gross income) | | | | | |
| | First stage | | IV | | |
| Log income | 0.141*** | 23.729 | 0.556*** | 6.630 | 25315 |
| Splines | 0.123*** | 21.927 | 0.397*** | 4.146 | 25315 |
| Spousal income controls | 0.029 | 1.181 | 2.002 | 0.977 | 20288 |
| 2003-05 | 0.123*** | 21.927 | 0.474*** | 4.897 | 25315 |
| 2003-05, transitory | 0.124*** | 22.766 | 0.434*** | 4.939 | 25315 |

Table 8: Business owners only — using spouse owning a business as an instrument

| Variable | Coefficient (1) | t-value (2) | Coefficient (3) | t-value (4) | N (5) |
|----------------------------|--------------------|----------------|--------------------|----------------|----------|
| | OLS | | IV | | |
| Gross income | | | | | |
| First stage | | | 0.117*** | 22.666 | 25315 |
| 2002-2005 | 0.653*** | 50.415 | 0.453*** | 4.914 | 25315 |
| 2002-2003 | 0.362*** | 37.132 | -0.017 | -0.235 | 25315 |
| 2003-2004 | 0.273*** | 25.039 | 0.305*** | 3.948 | 25315 |
| 2004-2005 | 0.018 | 1.632 | 0.165** | 2.060 | 25315 |
| Business income | | | | | |
| First stage | | | 0.117*** | 22.666 | 25315 |
| 2002-2005 | 0.748*** | 39.497 | 0.496*** | 3.687 | 25315 |
| 2002-2003 | 0.396*** | 27.671 | -0.088 | -0.850 | 25315 |
| 2003-2004 | 0.313*** | 21.144 | 0.329*** | 3.146 | 25315 |
| 2004-2005 | 0.040*** | 2.596 | 0.255** | 2.350 | 25315 |
| Business revenue | | | | | |
| First stage | | | 0.117*** | 22.666 | 25315 |
| 2002-2005 | 0.382*** | 28.195 | 0.263*** | 2.735 | 25315 |
| 2002-2003 | 0.162*** | 19.197 | -0.043 | -0.710 | 25315 |
| 2003-2004 | 0.163*** | 21.880 | 0.099* | 1.867 | 25315 |
| 2004-2005 | 0.057*** | 6.778 | 0.207*** | 3.427 | 25315 |
| Business cost | | | | | |
| First stage | | | 0.116*** | 22.471 | 25062 |
| 2002-2005 | 0.269*** | 17.454 | 0.203* | 1.859 | 25062 |
| 2002-2003 | 0.108*** | 10.973 | -0.092 | -1.303 | 25114 |
| 2003-2004 | 0.116*** | 13.636 | 0.126** | 2.079 | 25128 |
| 2004-2005 | 0.047*** | 4.961 | 0.201*** | 2.991 | 25090 |
| Tax liability | | | | | |
| First stage | | | 0.120*** | 22.450 | 24071 |
| 2002-2005 | 0.700*** | 42.595 | -0.012 | -0.103 | 24071 |
| 2002-2003 | 0.479*** | 35.336 | -0.133 | -1.337 | 24149 |
| 2003-2004 | 0.234*** | 16.487 | 0.020 | 0.195 | 24198 |
| 2004-2005 | -0.022 | -1.634 | 0.041 | 0.431 | 24237 |
| Sensitivity (gross income) | | | | | |
| | First stage | | IV | | |
| Log income | 0.127*** | 23.083 | 0.534*** | 6.190 | 25315 |
| Splines | 0.117*** | 22.666 | 0.453*** | 4.914 | 25315 |
| Spousal income controls | 0.077*** | 13.045 | 0.490*** | 3.127 | 20288 |
| 2003-05 | 0.117*** | 22.666 | 0.470*** | 5.023 | 25315 |
| 2003-05, transitory | 0.117*** | 23.348 | 0.461*** | 5.387 | 25315 |

Table 9: Business owners only — using ratio of incomes as an instrument

| Variable | Coefficient (1) | t-value (2) | Coefficient (3) | t-value (4) | N (5) |
|----------------------------|--------------------|----------------|--------------------|----------------|----------|
| | OLS | | IV | | |
| Gross income | | | | | |
| First stage | | | 0.074*** | 14.811 | 25315 |
| 2002-2005 | 0.653*** | 50.415 | 0.420*** | 2.982 | 25315 |
| 2002-2003 | 0.362*** | 37.132 | -0.222** | -1.970 | 25315 |
| 2003-2004 | 0.273*** | 25.039 | 0.387*** | 3.279 | 25315 |
| 2004-2005 | 0.018 | 1.632 | 0.255** | 2.075 | 25315 |
| Business income | | | | | |
| First stage | | | 0.074*** | 14.811 | 25315 |
| 2002-2005 | 0.748*** | 39.497 | 0.392* | 1.902 | 25315 |
| 2002-2003 | 0.396*** | 27.671 | -0.185 | -1.162 | 25315 |
| 2003-2004 | 0.313*** | 21.144 | 0.336** | 2.103 | 25315 |
| 2004-2005 | 0.040*** | 2.596 | 0.241 | 1.458 | 25315 |
| Business revenue | | | | | |
| First stage | | | 0.074*** | 14.811 | 25315 |
| 2002-2005 | 0.382*** | 28.195 | 0.103 | 0.695 | 25315 |
| 2002-2003 | 0.162*** | 19.197 | -0.052 | -0.560 | 25315 |
| 2003-2004 | 0.163*** | 21.880 | 0.067 | 0.831 | 25315 |
| 2004-2005 | 0.057*** | 6.778 | 0.087 | 0.952 | 25315 |
| Business cost | | | | | |
| First stage | | | 0.074*** | 14.769 | 25062 |
| 2002-2005 | 0.269*** | 17.454 | 0.123 | 0.738 | 25062 |
| 2002-2003 | 0.108*** | 10.973 | -0.025 | -0.235 | 25114 |
| 2003-2004 | 0.116*** | 13.636 | 0.059 | 0.647 | 25128 |
| 2004-2005 | 0.047*** | 4.961 | 0.075 | 0.740 | 25090 |
| Tax liability | | | | | |
| First stage | | | 0.076*** | 14.661 | 24071 |
| 2002-2005 | 0.700*** | 42.595 | -0.019 | -0.102 | 24071 |
| 2002-2003 | 0.479*** | 35.336 | -0.379** | -2.456 | 24149 |
| 2003-2004 | 0.234*** | 16.487 | 0.257* | 1.703 | 24198 |
| 2004-2005 | -0.022 | -1.634 | 0.041 | 0.275 | 24237 |
| Sensitivity (gross income) | | | | | |
| | First stage | | IV | | |
| Log income | 0.024*** | 4.575 | -1.214** | -2.013 | 25315 |
| Splines | 0.074*** | 14.811 | 0.420*** | 2.982 | 25315 |
| Spousal income controls | 0.039*** | 6.816 | 0.274 | 0.900 | 20288 |
| 2003-05 | 0.074*** | 14.811 | 0.642*** | 4.452 | 25315 |
| 2003-05, transitory | 0.076*** | 15.699 | 0.524*** | 4.126 | 25315 |

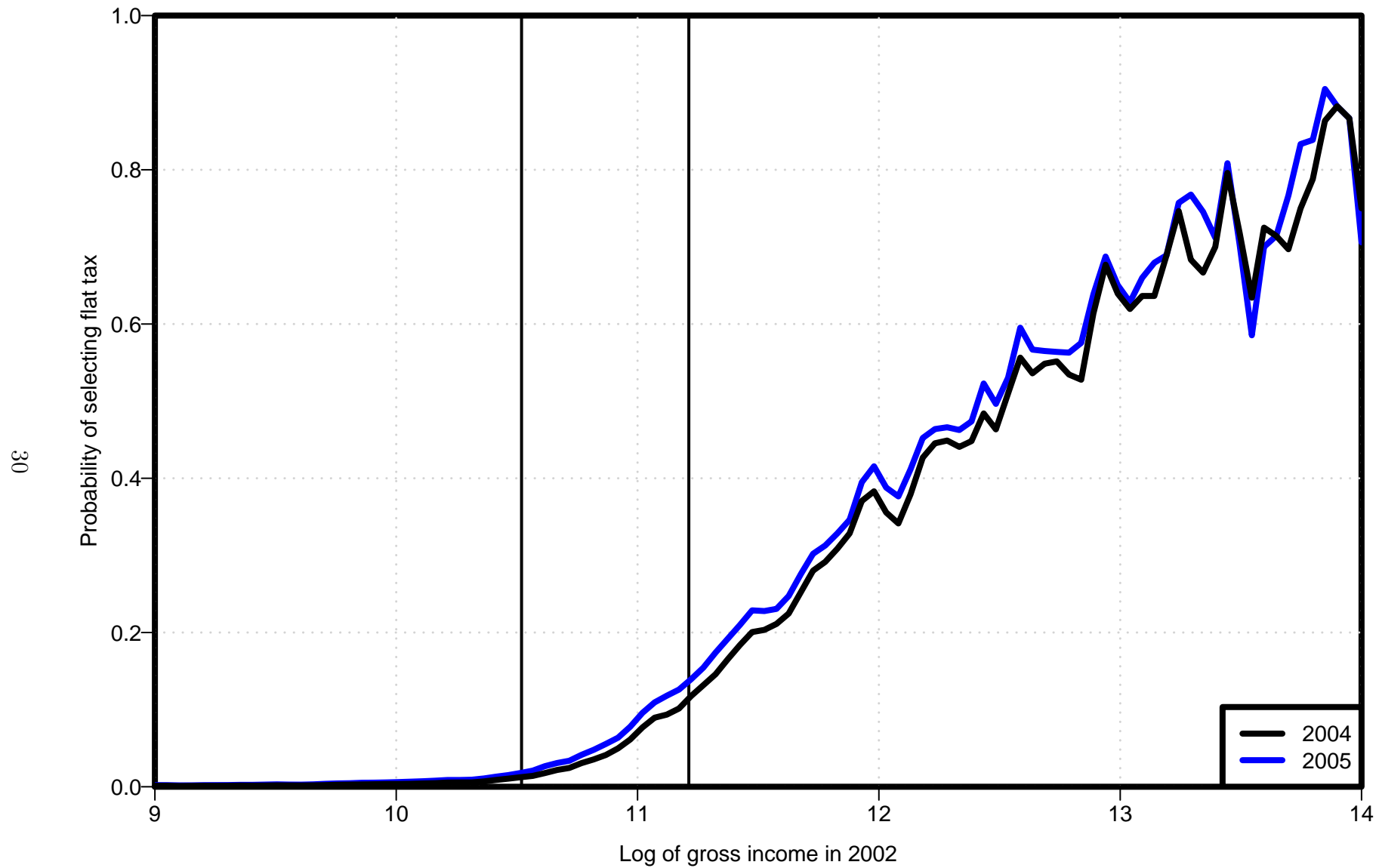


Figure 1: Selecting flat tax in 2004 and 2005, conditional on 2002 gross income (everyone)

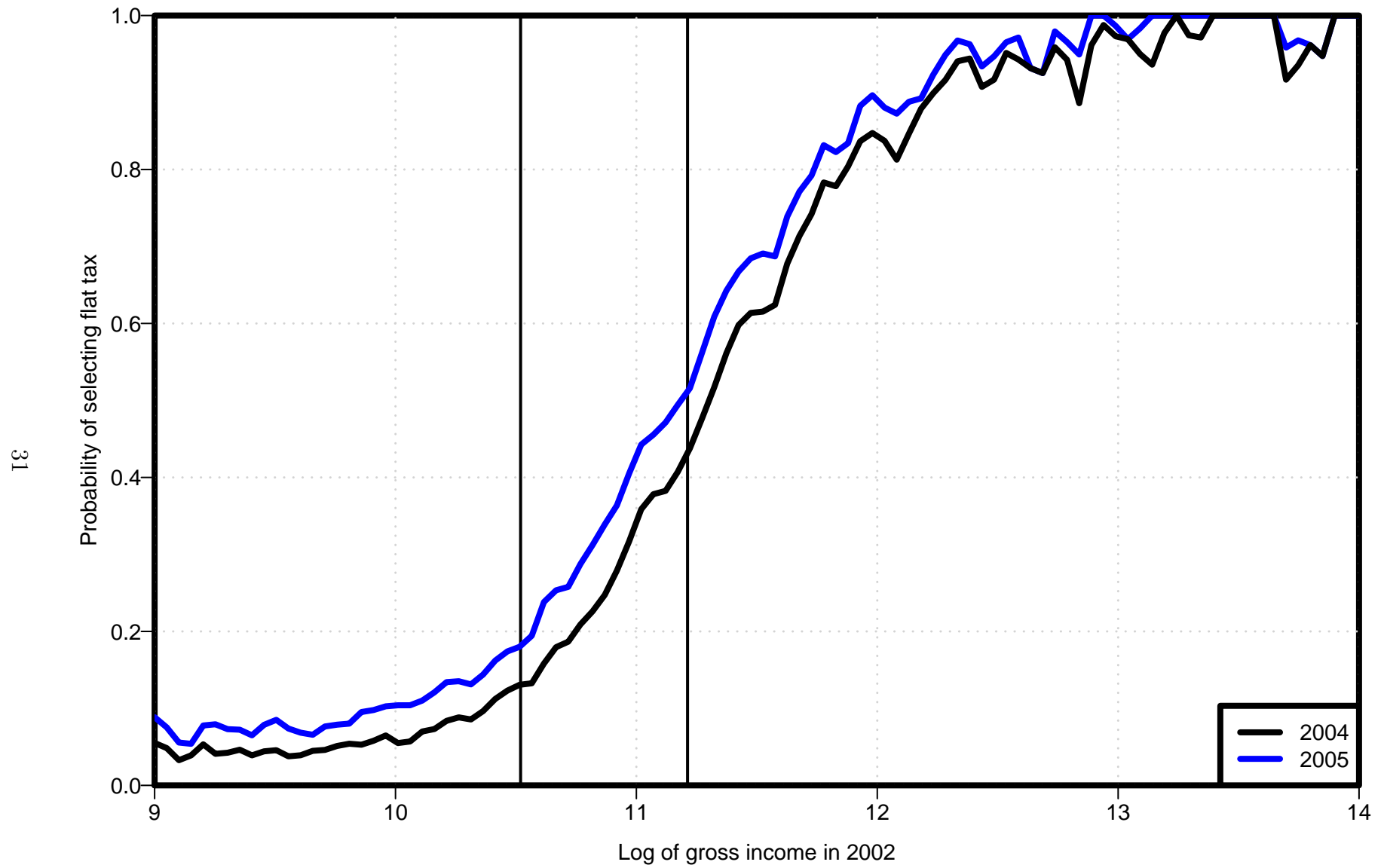


Figure 2: Selecting flat tax in 2004 and 2005, conditional on 2002 gross income (business owners)

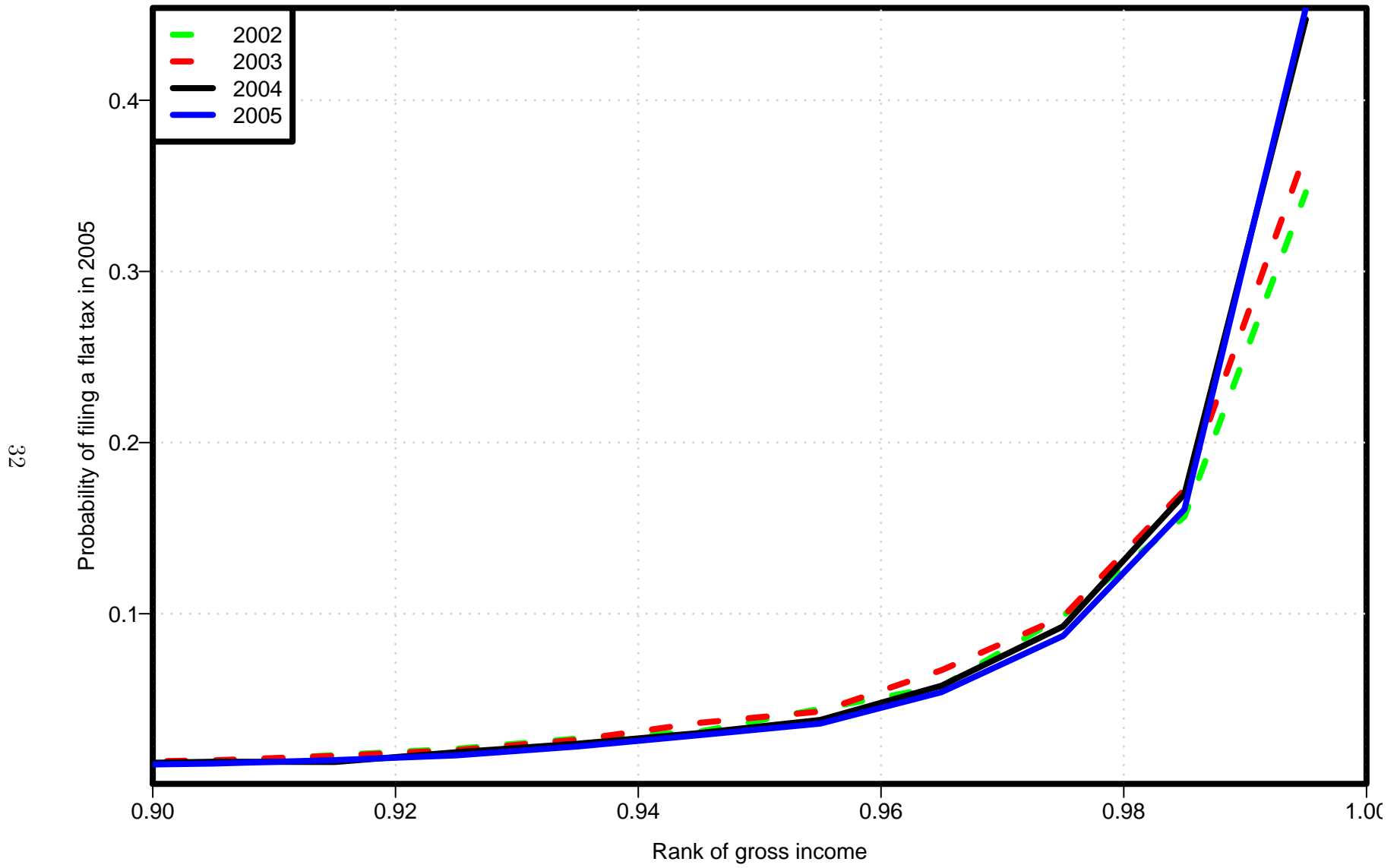


Figure 3: Probability of filing a flat tax in 2005 by location in the full income distribution

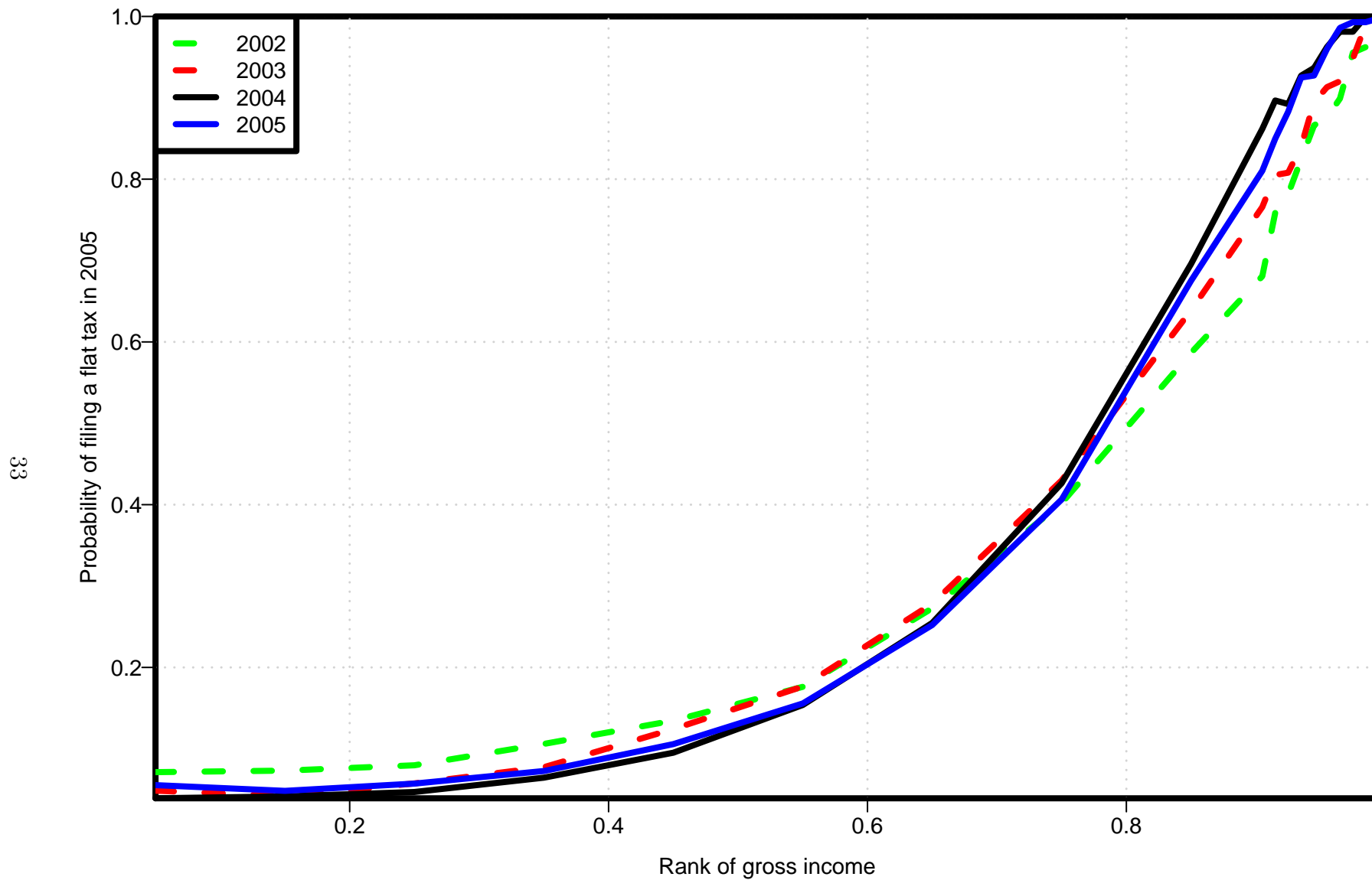


Figure 4: Probability of filing a flat tax in 2005 by location in the business owners distribution

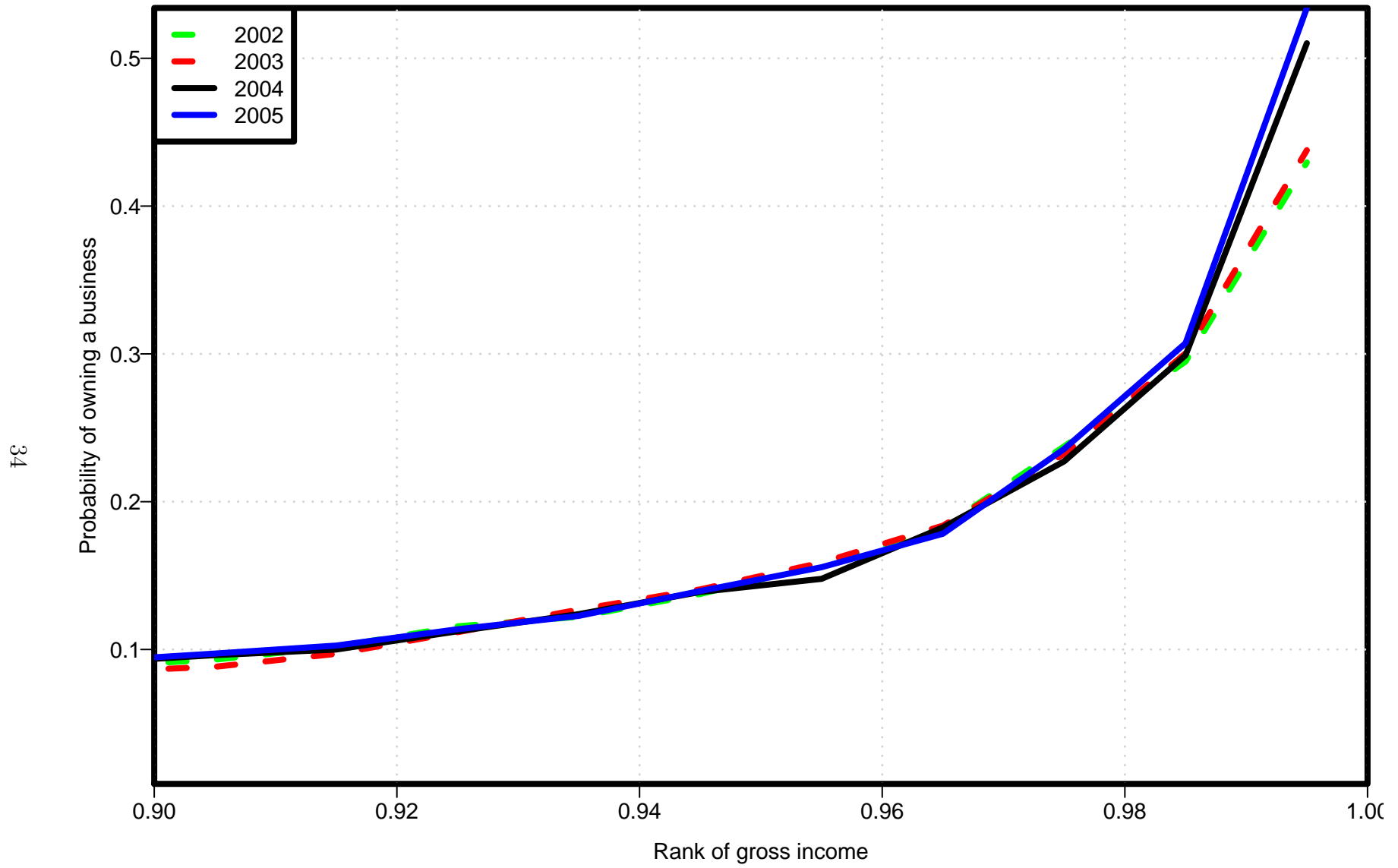


Figure 5: Probability of owning a business by location in the full income distribution

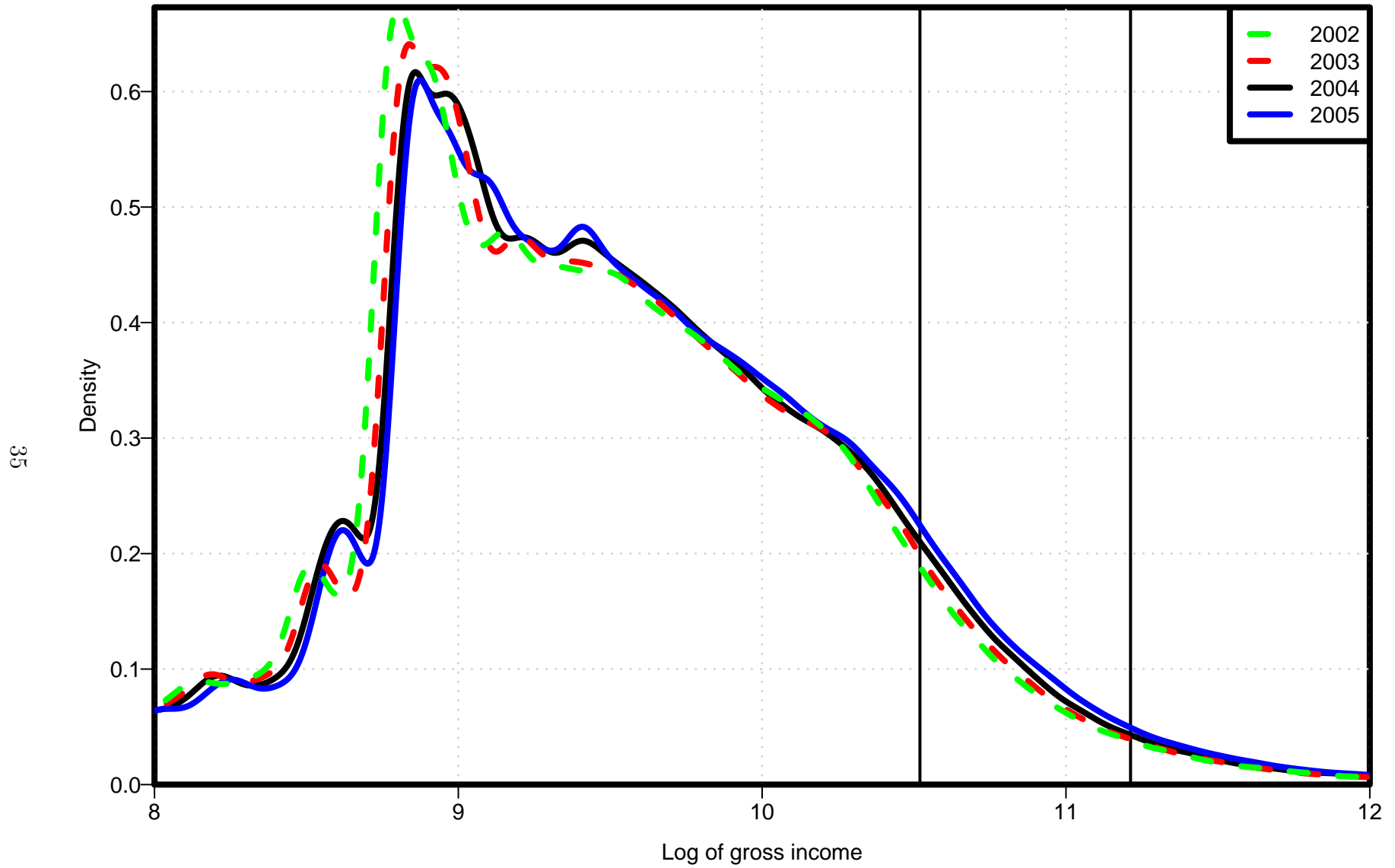


Figure 6: Distribution of gross income (everyone)

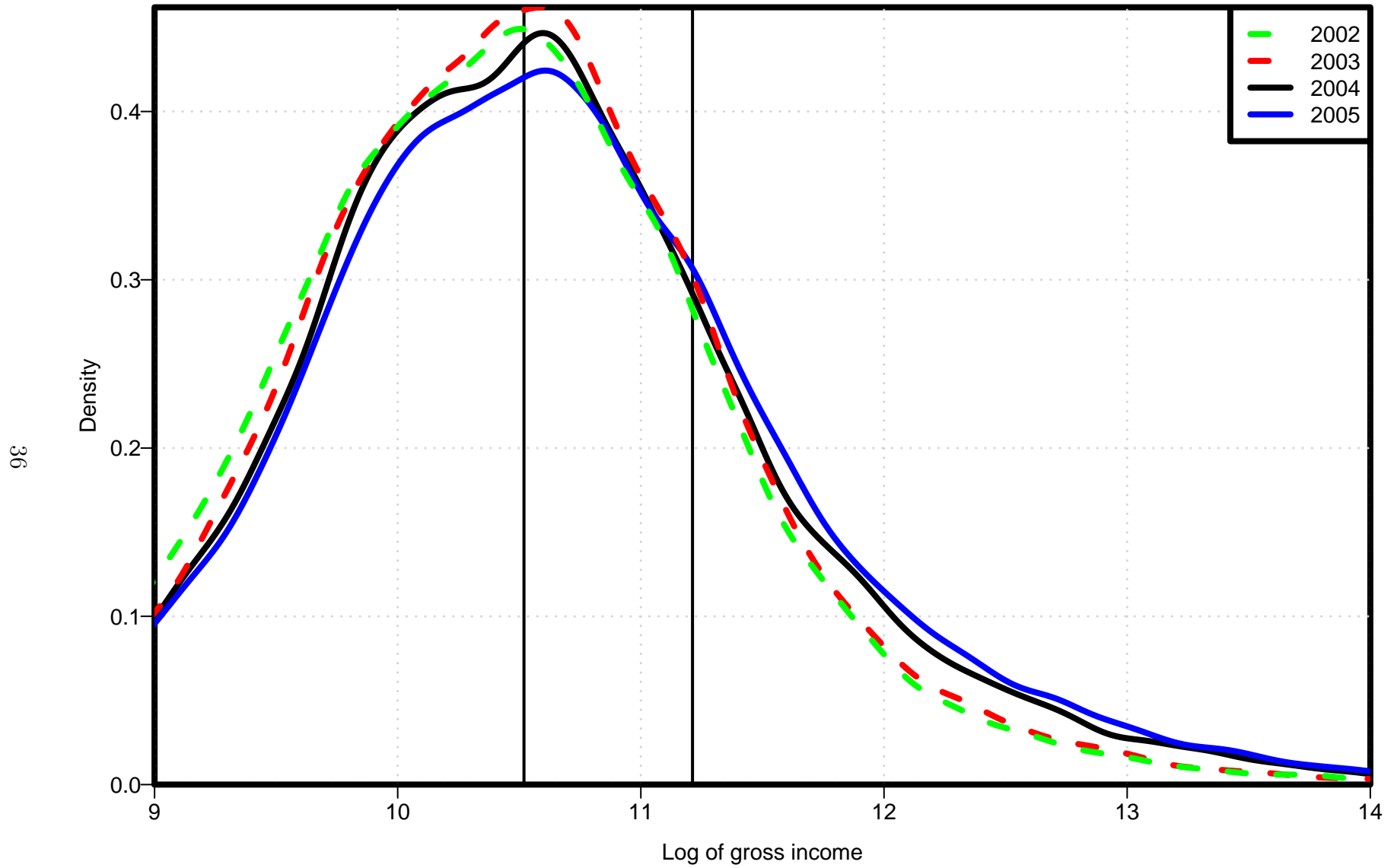


Figure 7: Distribution of gross income (business owners)

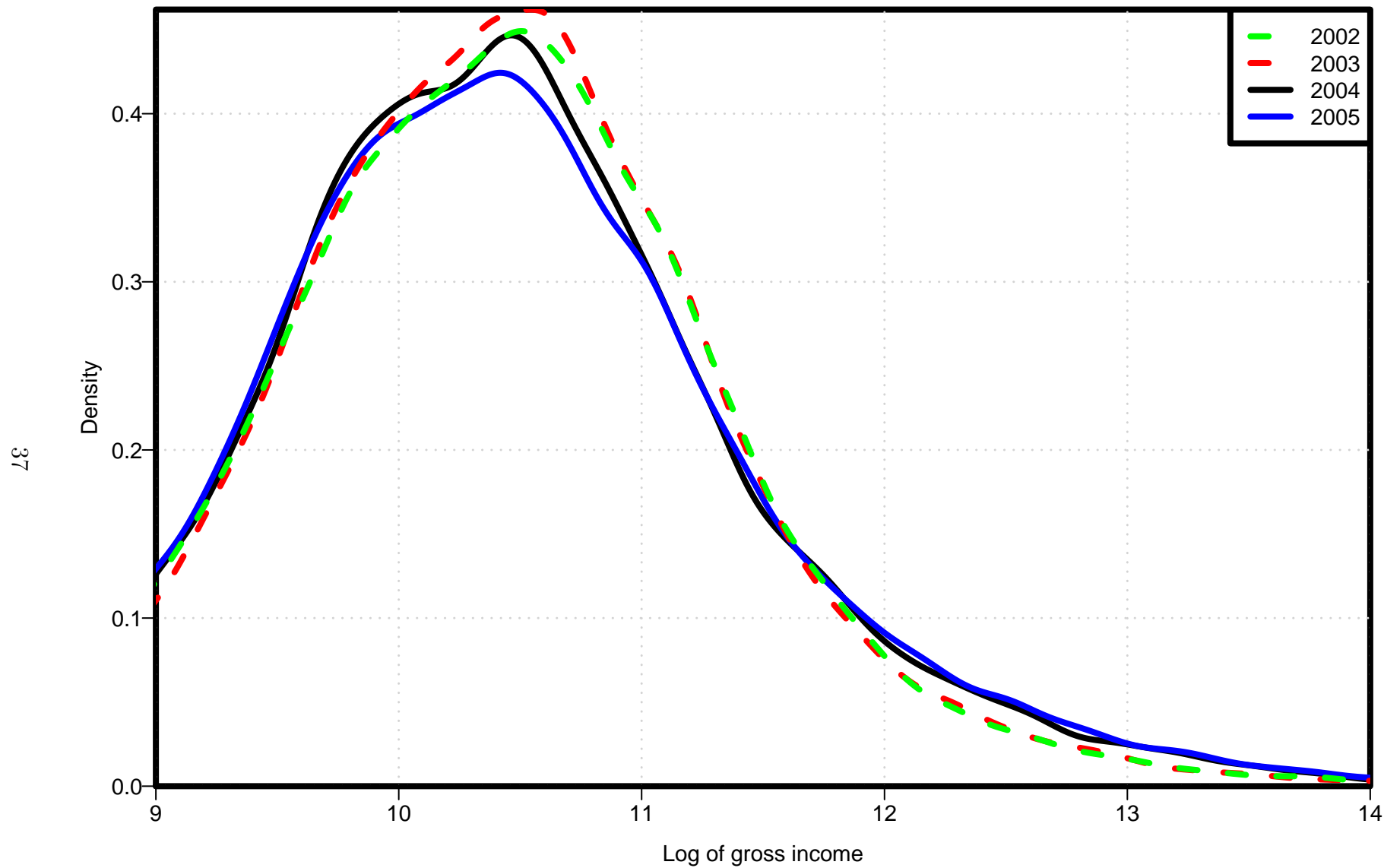


Figure 8: Distribution of gross income inflation/GDP adjusted (business owners)

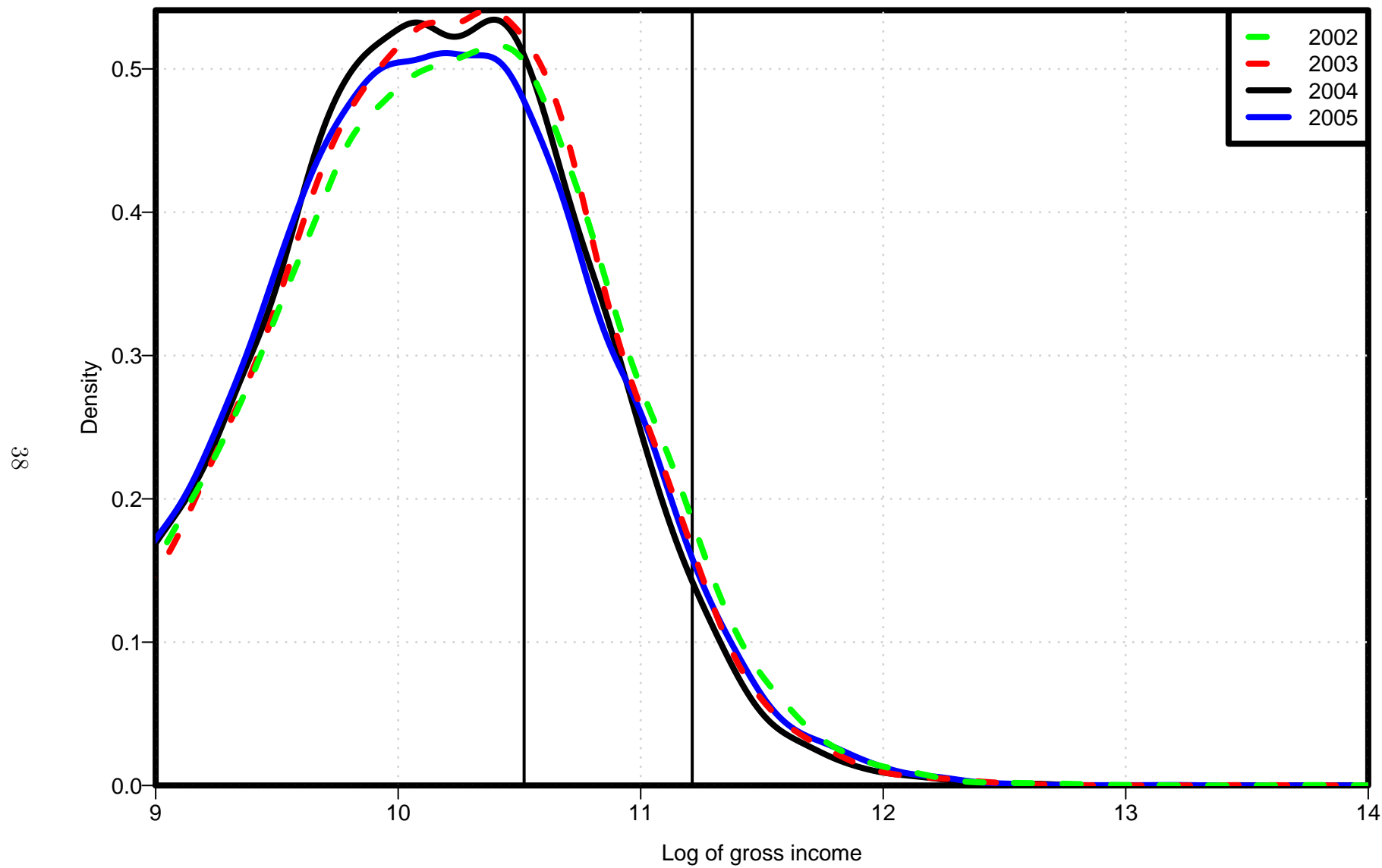


Figure 9: Distribution of gross income — business owners not on flat tax in 2005

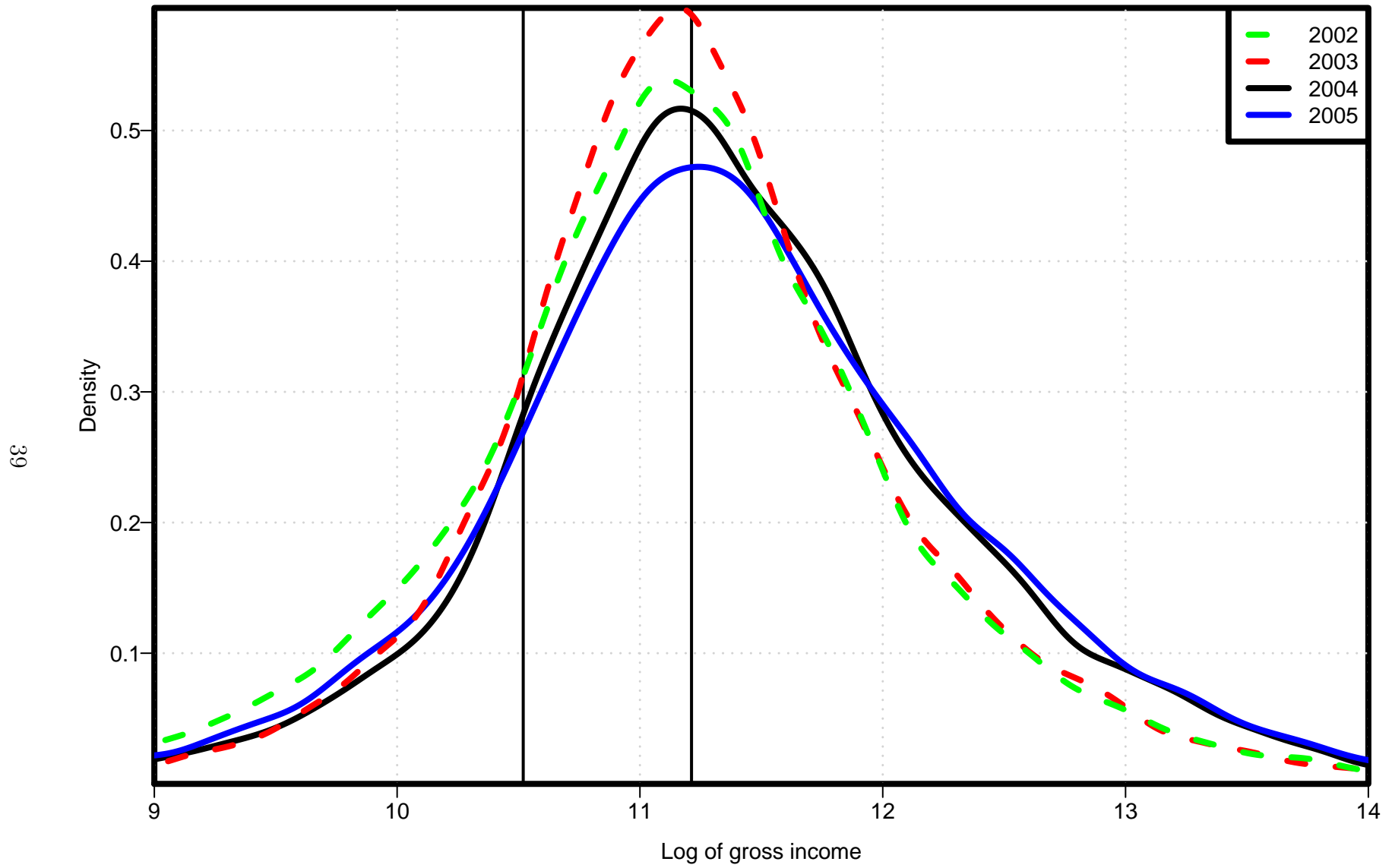


Figure 10: Distribution of gross income — business owners on flat tax in 2005

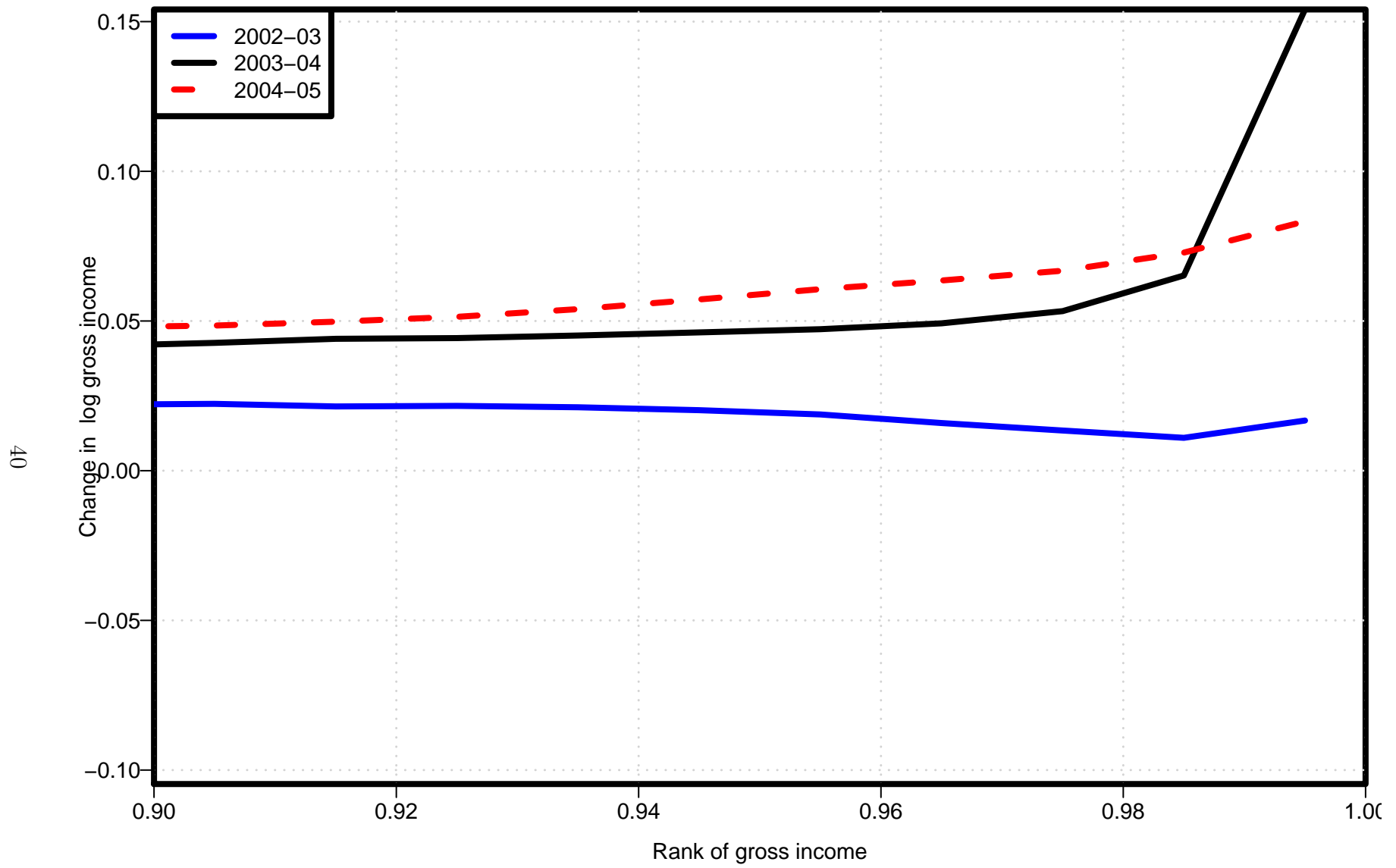


Figure 11: Change in gross income 2002-05 by location in the full income distribution

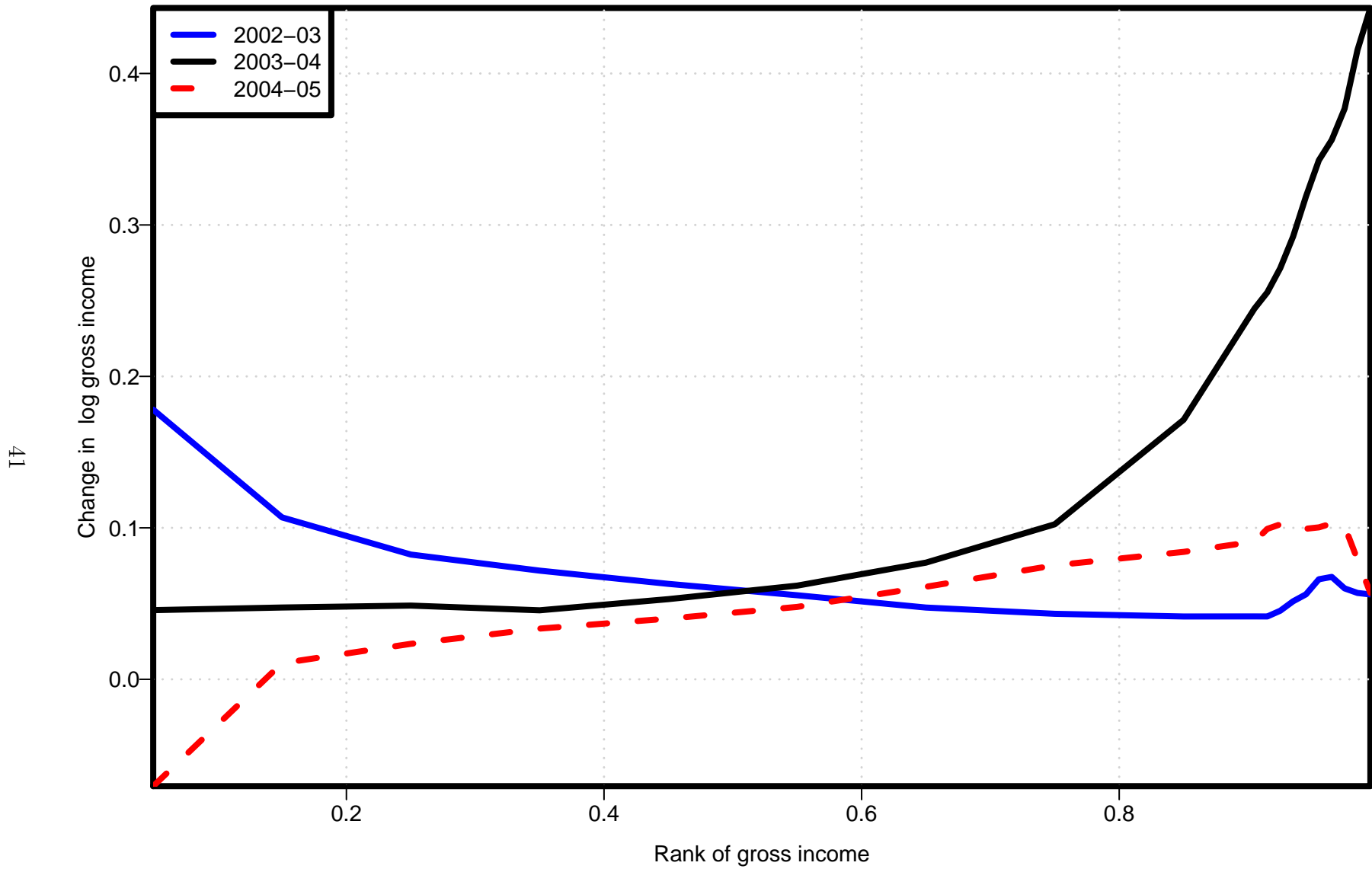


Figure 12: Change in gross income 2002-05 by location in the business owners distribution

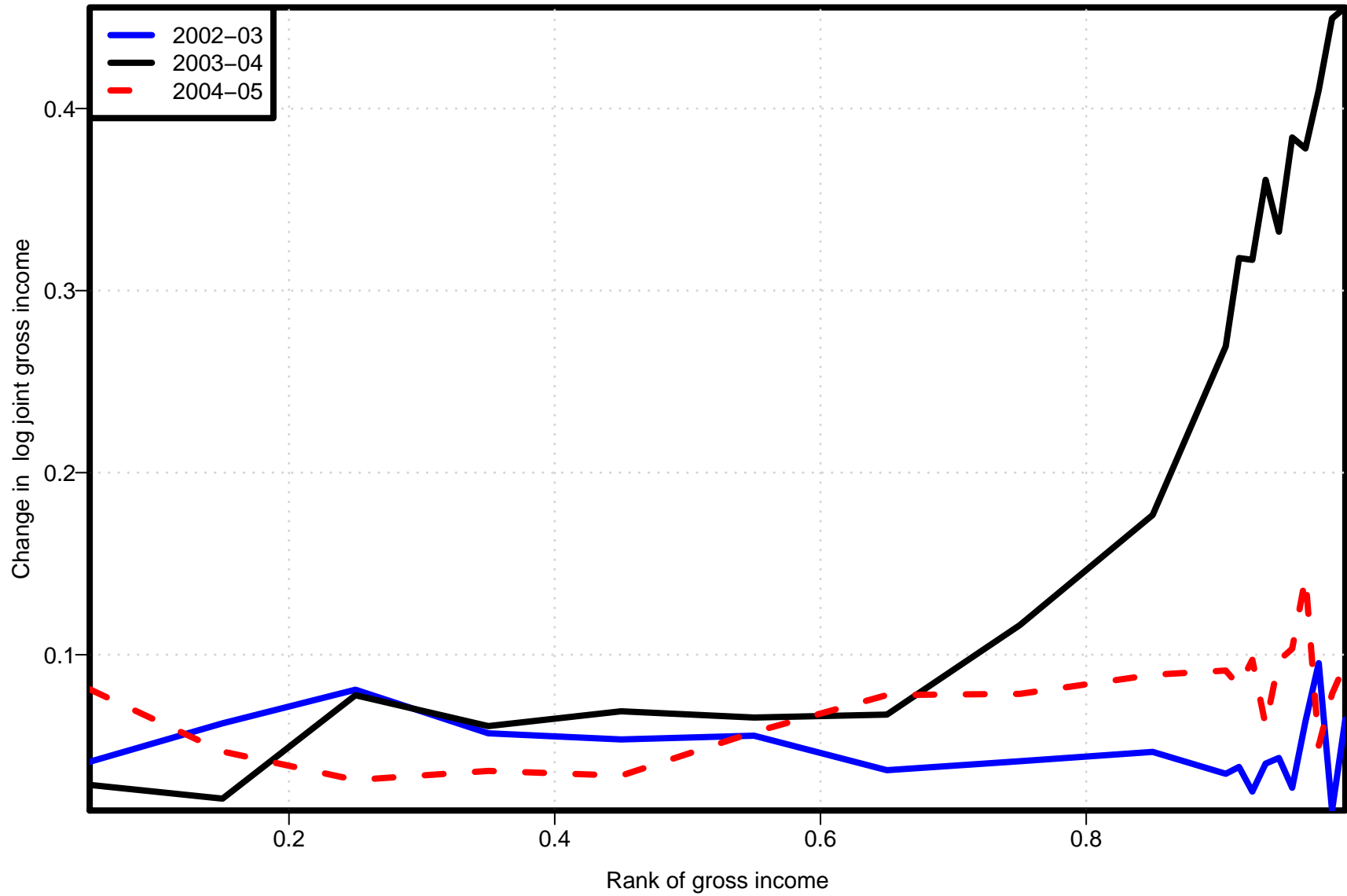


Figure 13: Change in joint gross income 2002-05 by location in the business owners distribution

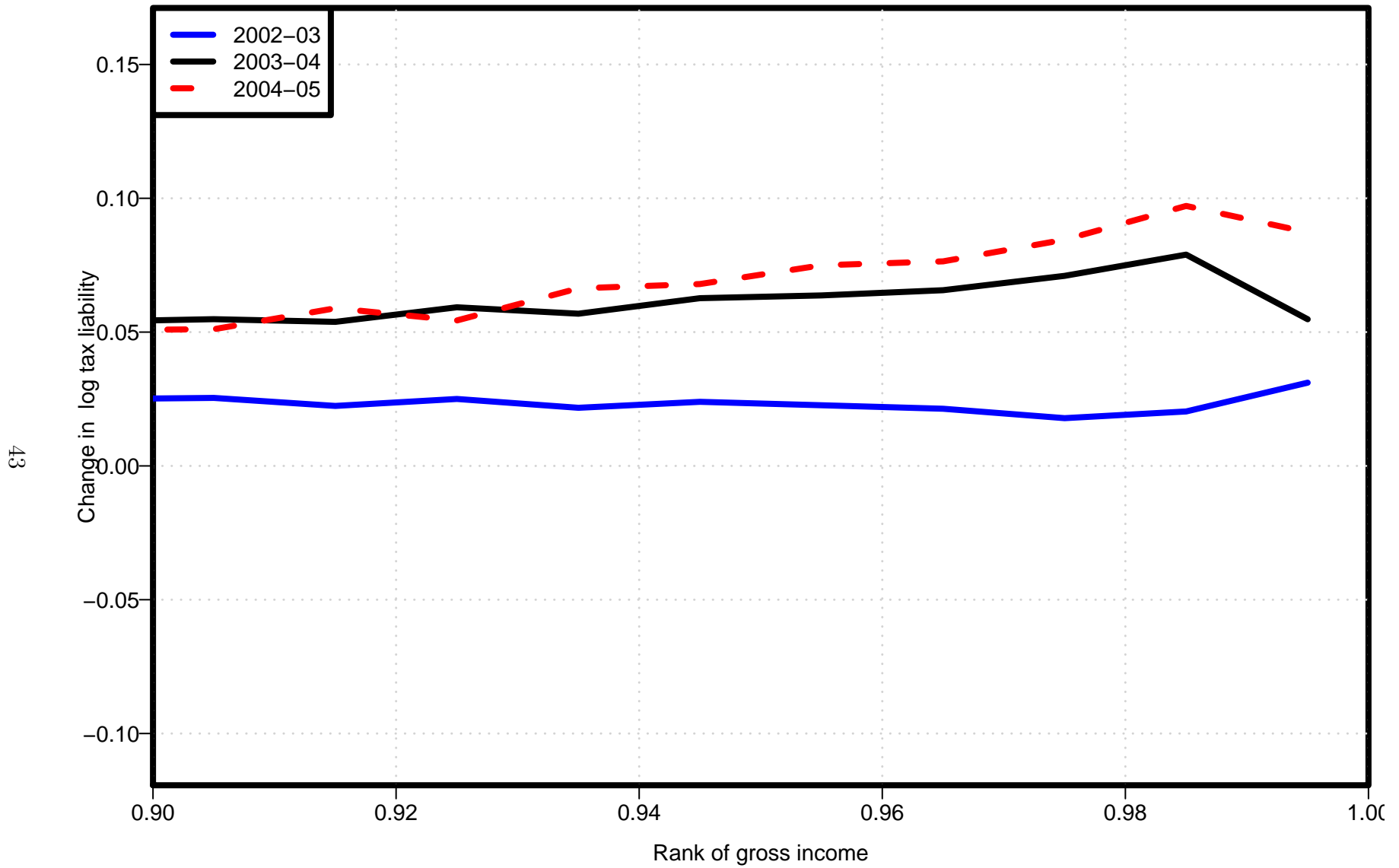


Figure 14: Change in tax liability 2002-05 by location in the full income distribution

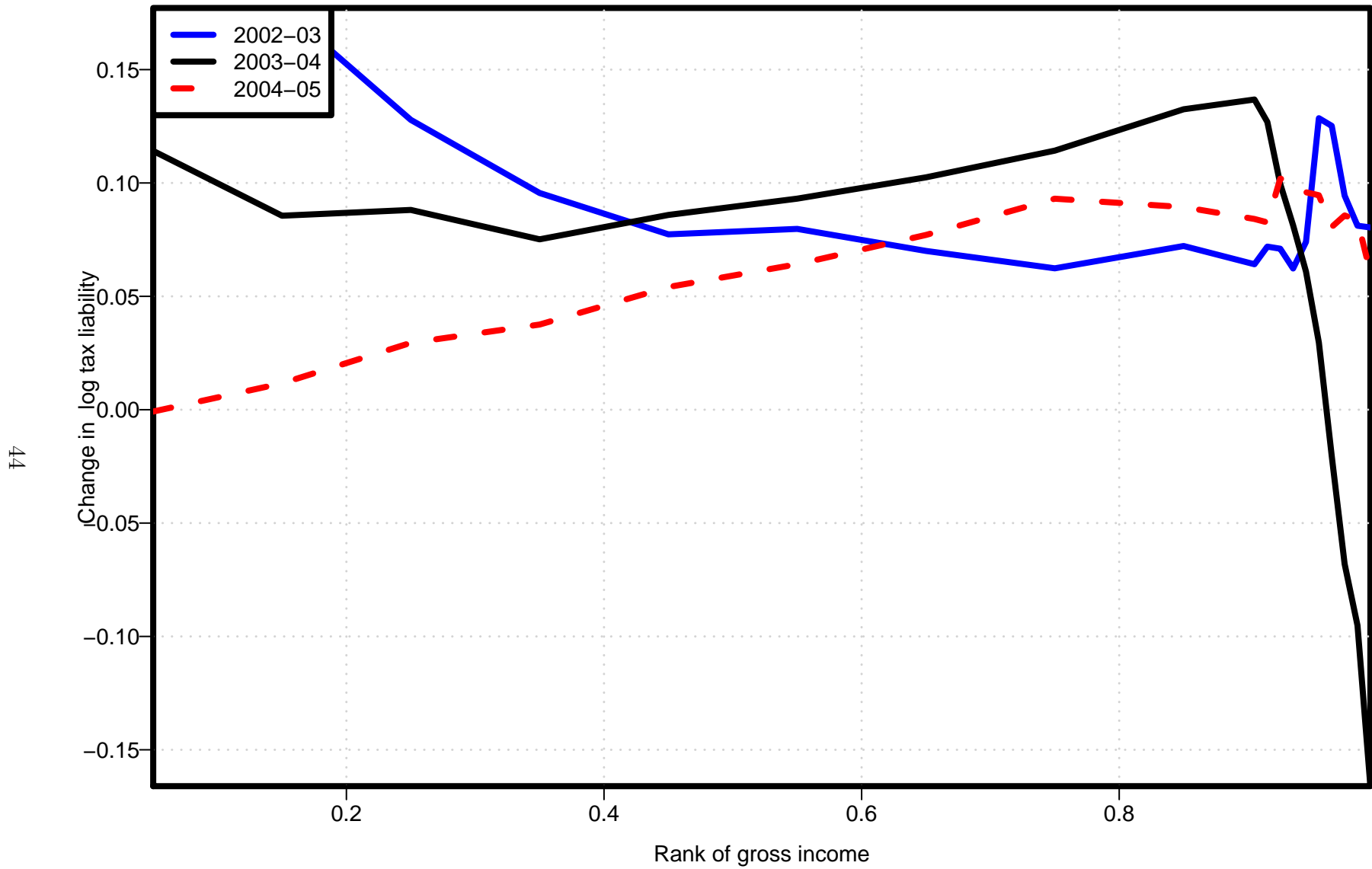


Figure 15: Change in tax liability 2002-05 by location in the business owners distribution

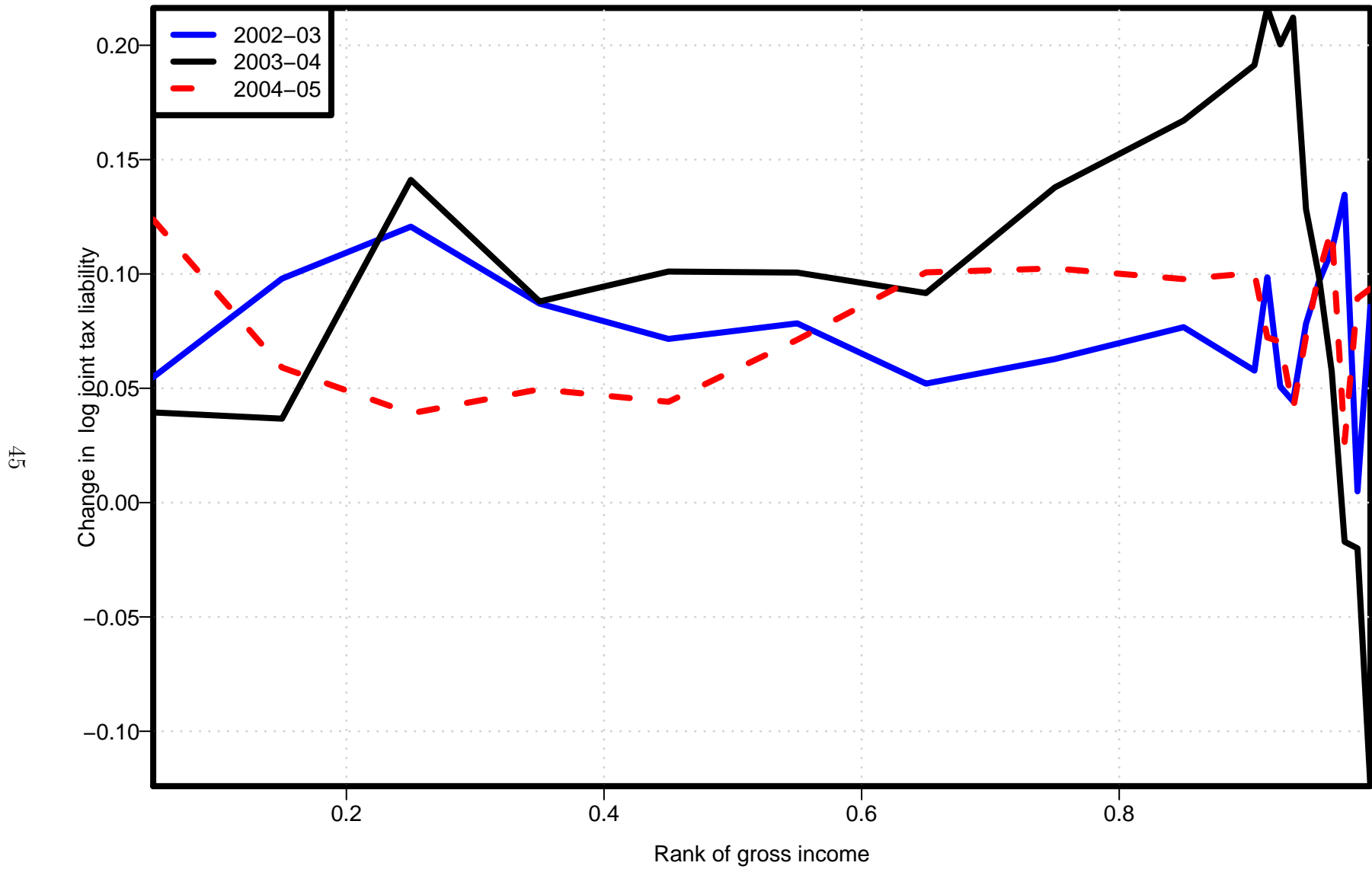


Figure 16: Change in joint tax liability 2002-05 by location in the business owners distribution

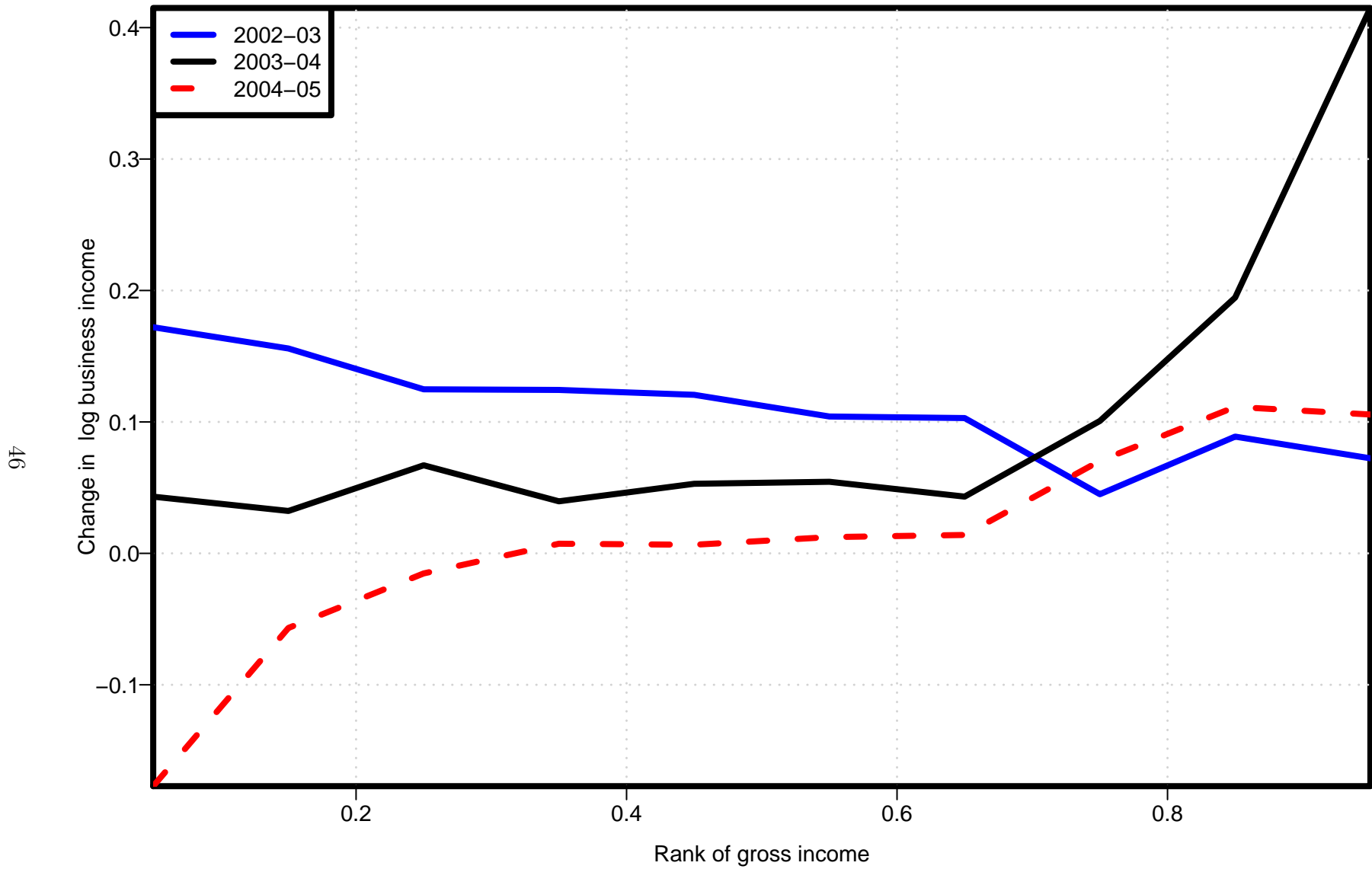


Figure 17: Change in business income 2002-05 by location in the business owners distribution

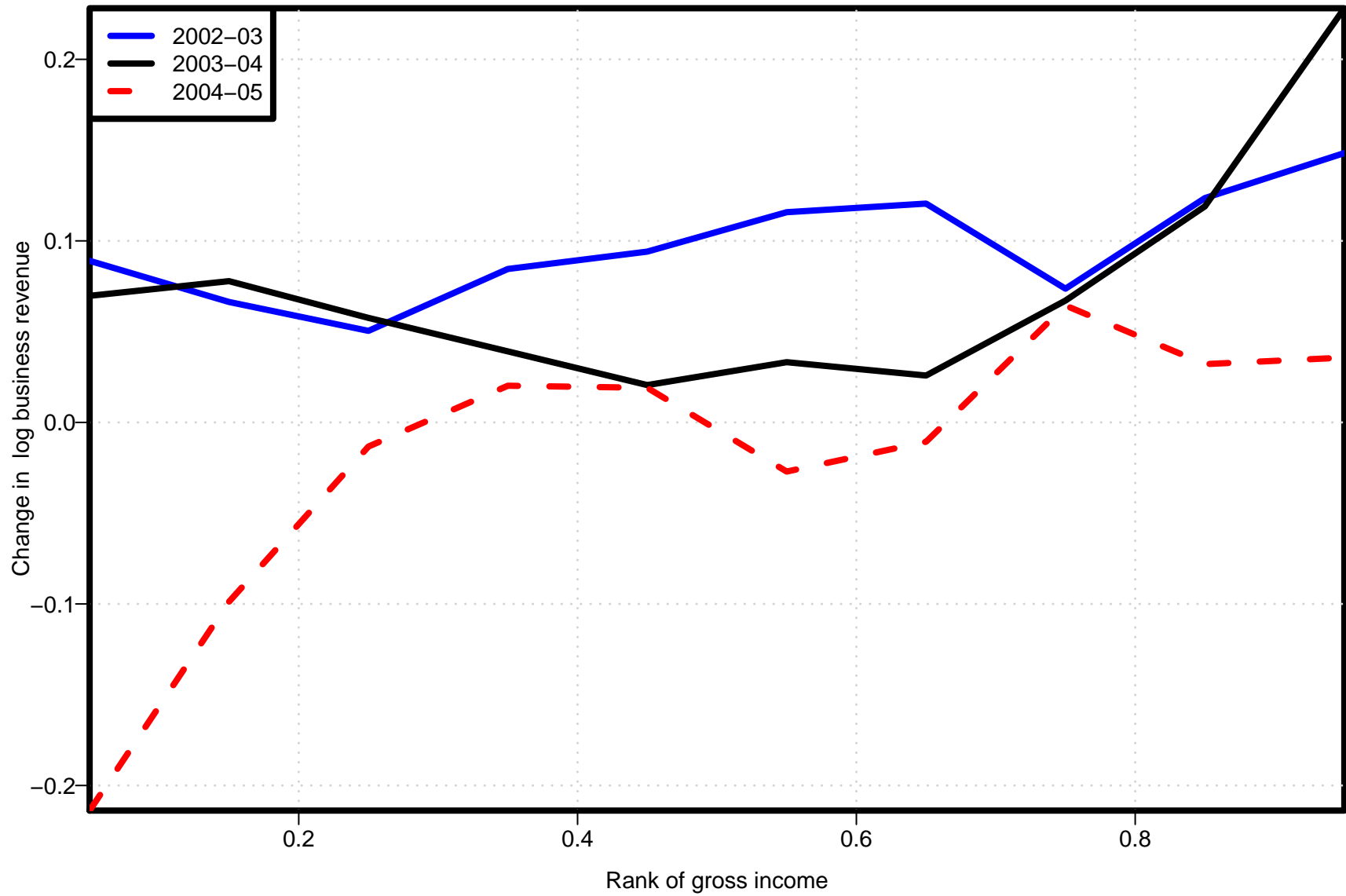


Figure 18: Change in business revenue 2002-05 by location in the business owners distribution

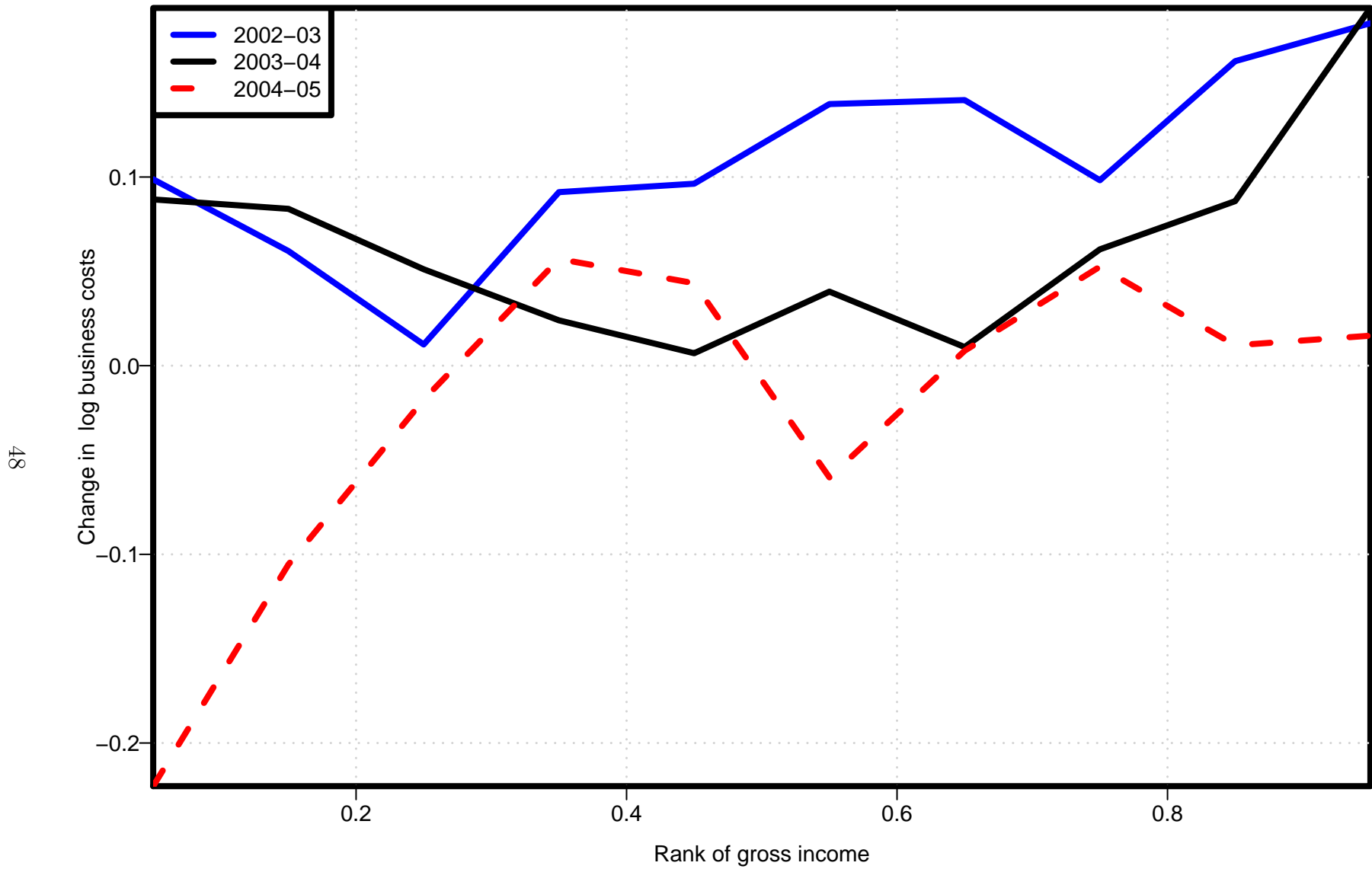


Figure 19: Change in business costs 2002-05 by location in the business owners distribution

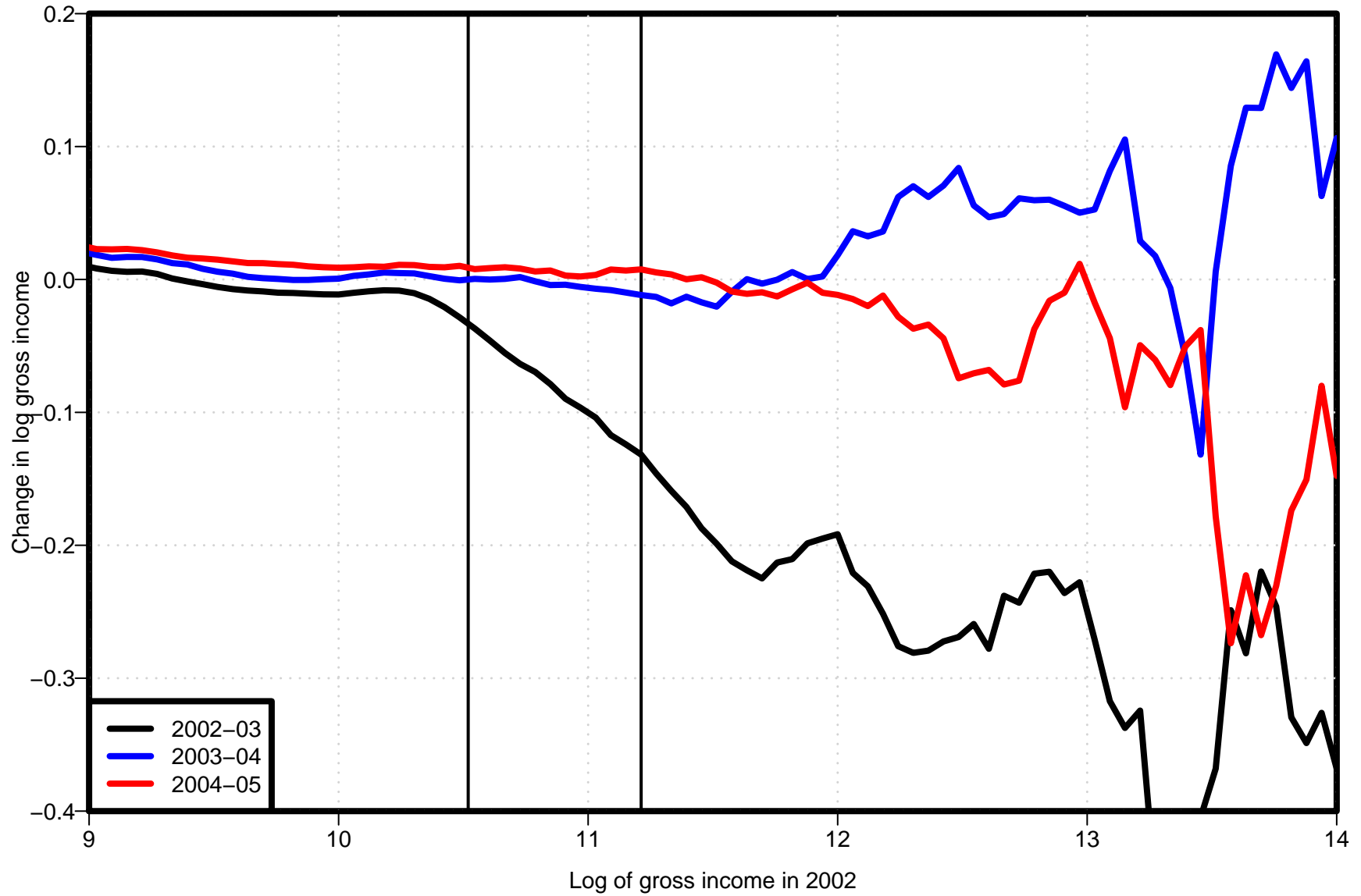


Figure 20: Changes in gross income in 2002-2005, everyone

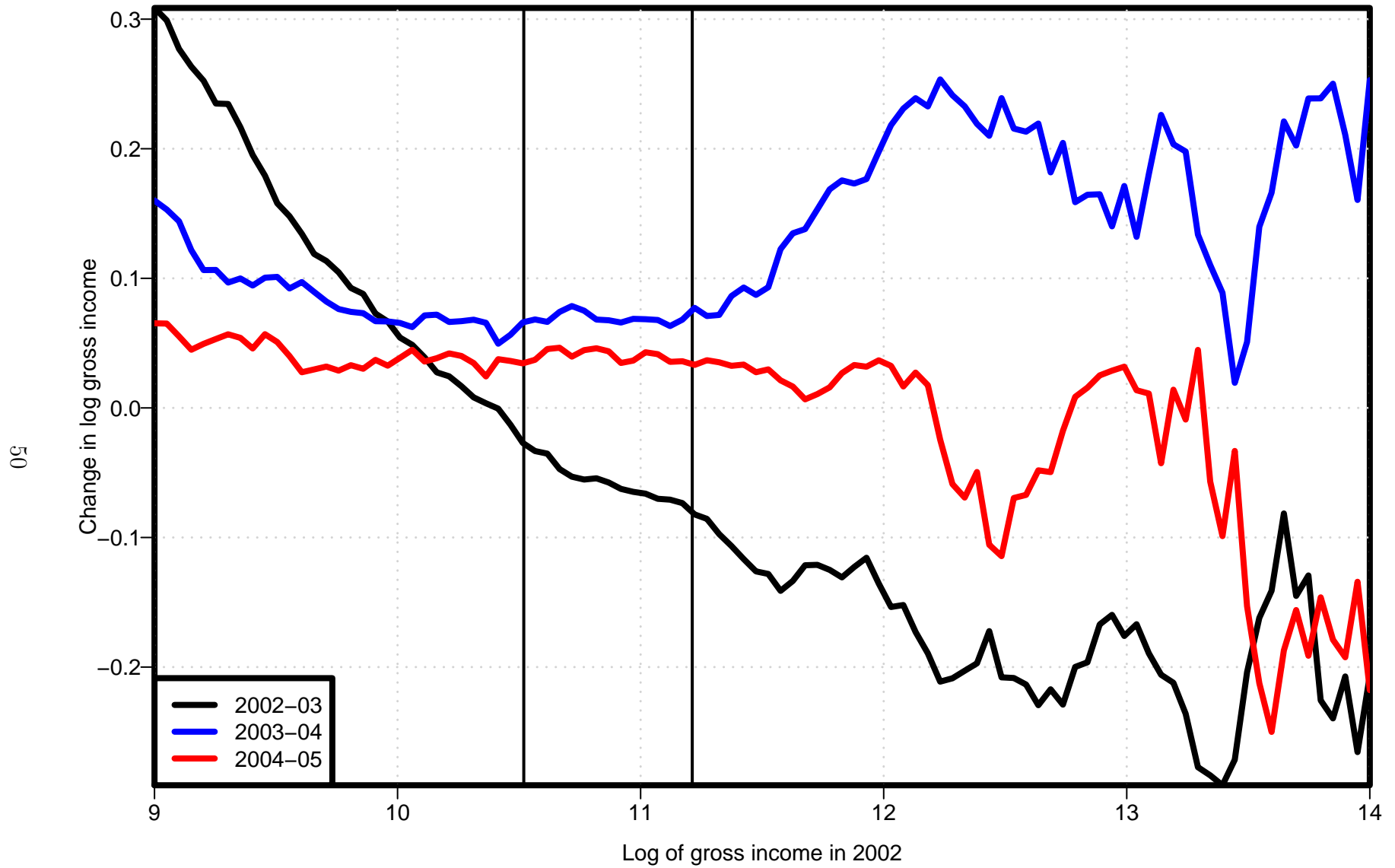


Figure 21: Changes in gross income in 2002-2005, business owners

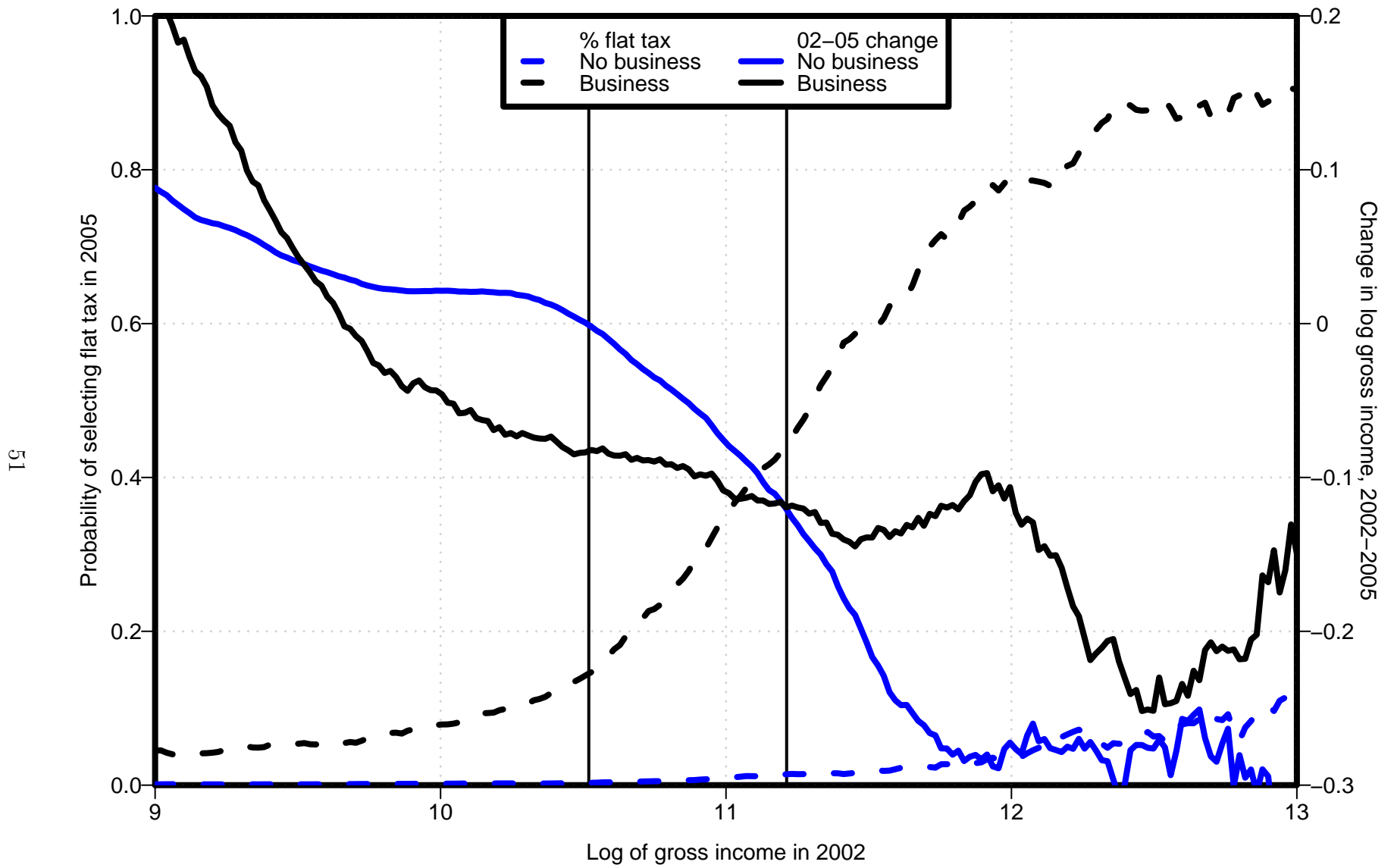


Figure 22: Flat tax and gross income change 2002-2005, conditional on owning a business in 2002, everyone

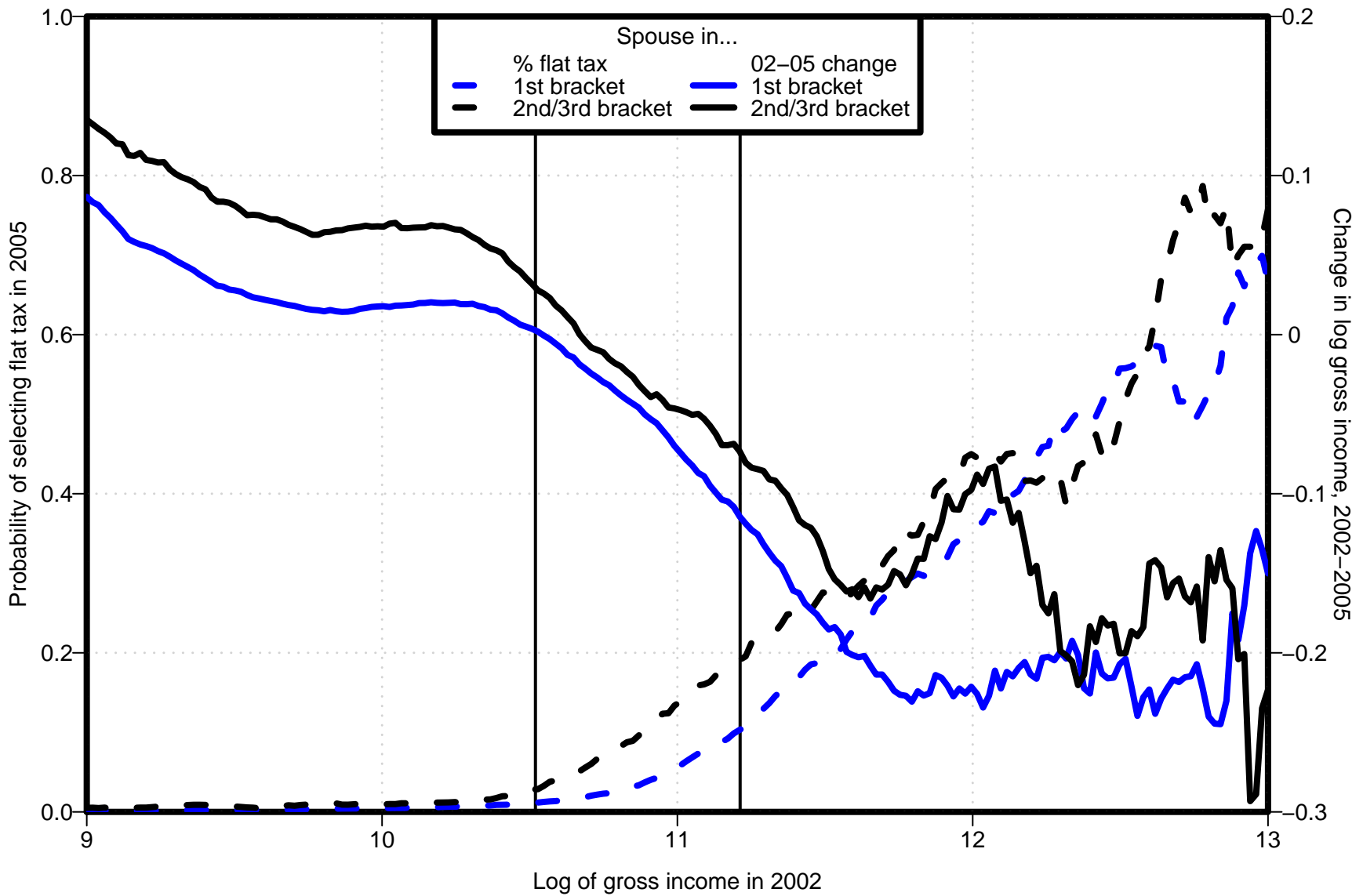


Figure 23: Flat tax and gross income change 2002-2005, conditional on having a spouse in a high tax bracket in 2002, everyone

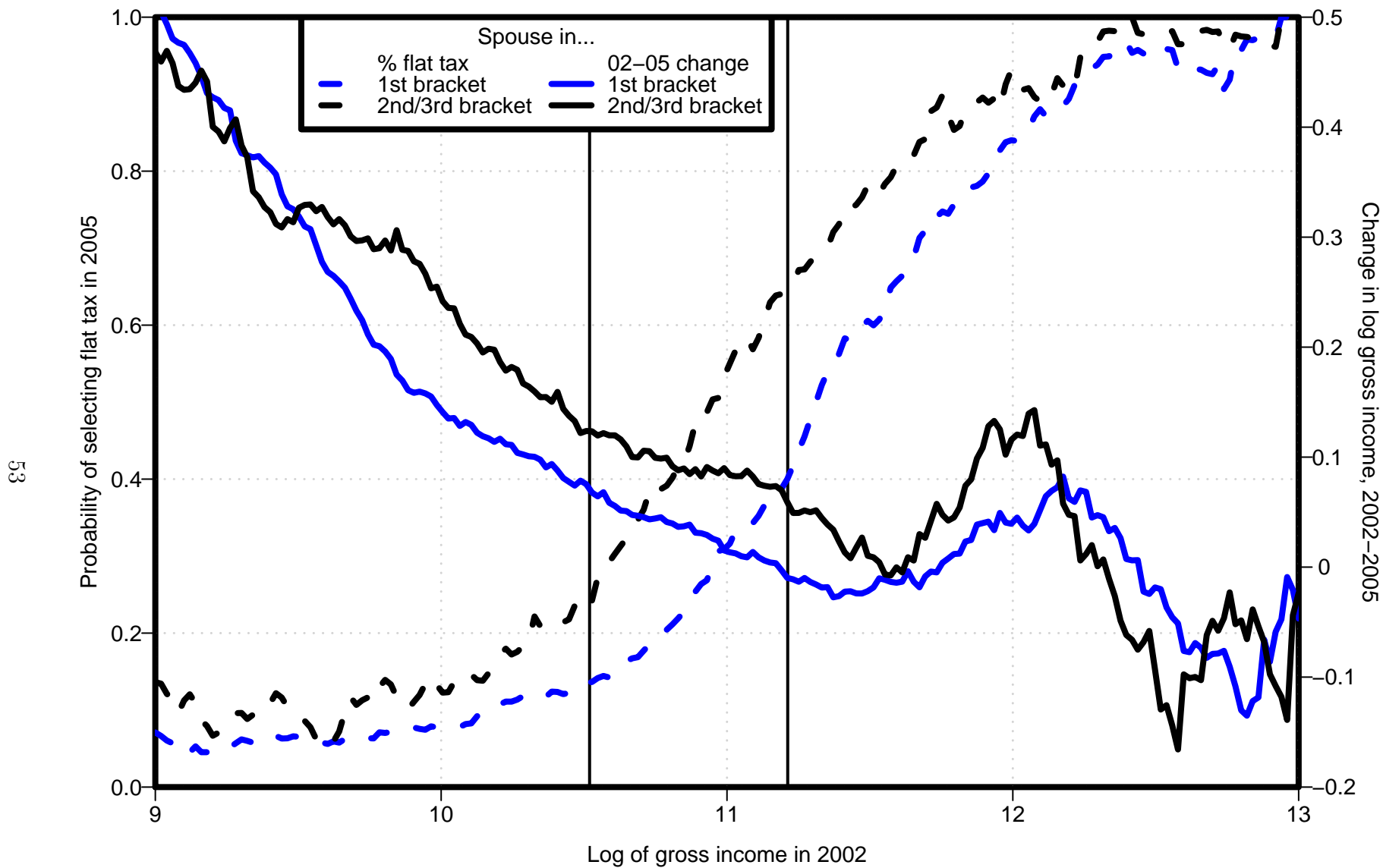


Figure 24: Flat tax and gross income change 2002-2005, conditional on having a spouse in a high tax bracket in 2002, business owners

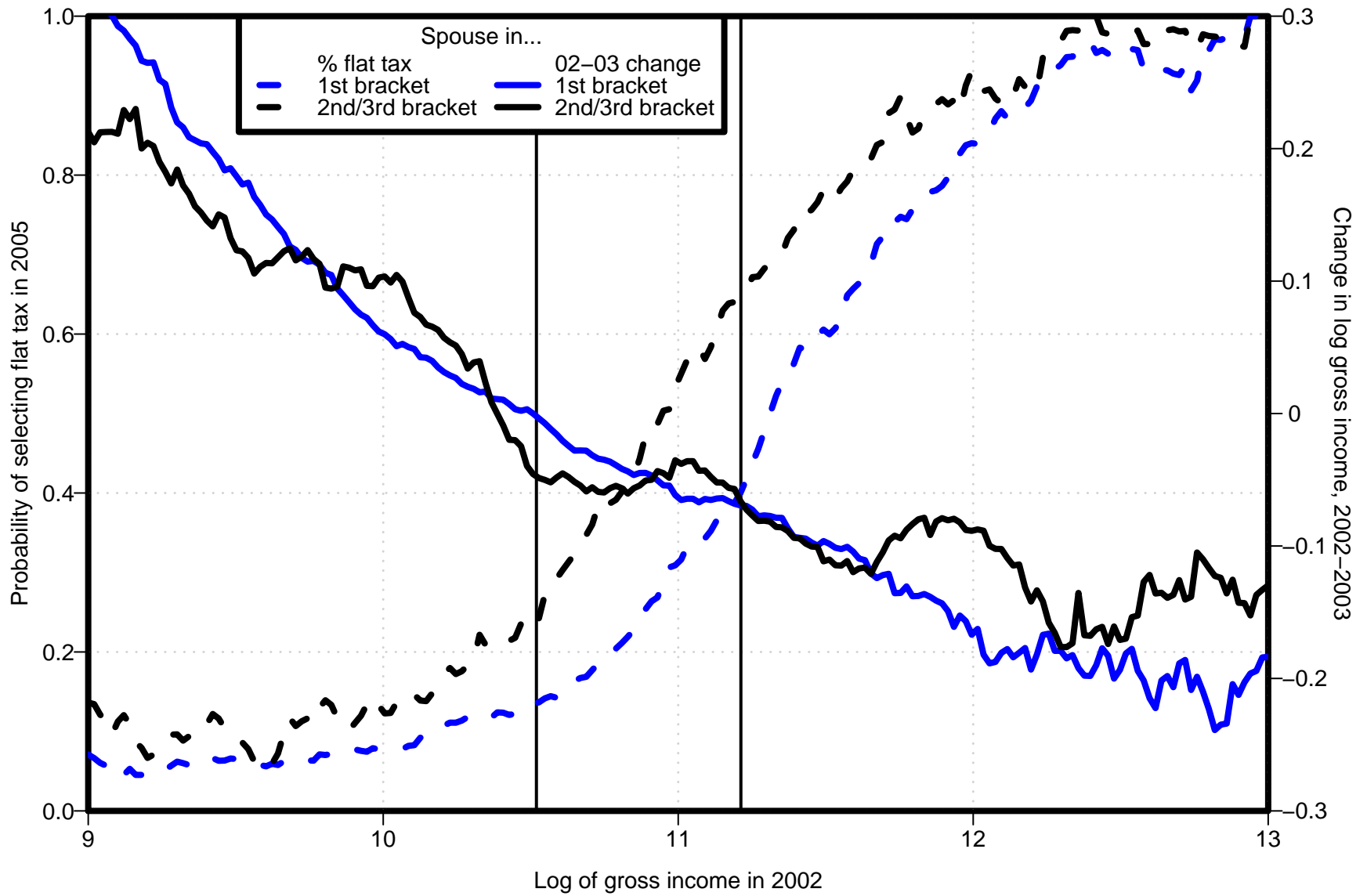


Figure 25: Flat tax and gross income change 2002-2003, conditional on having a spouse in a high tax bracket in 2002, business owners

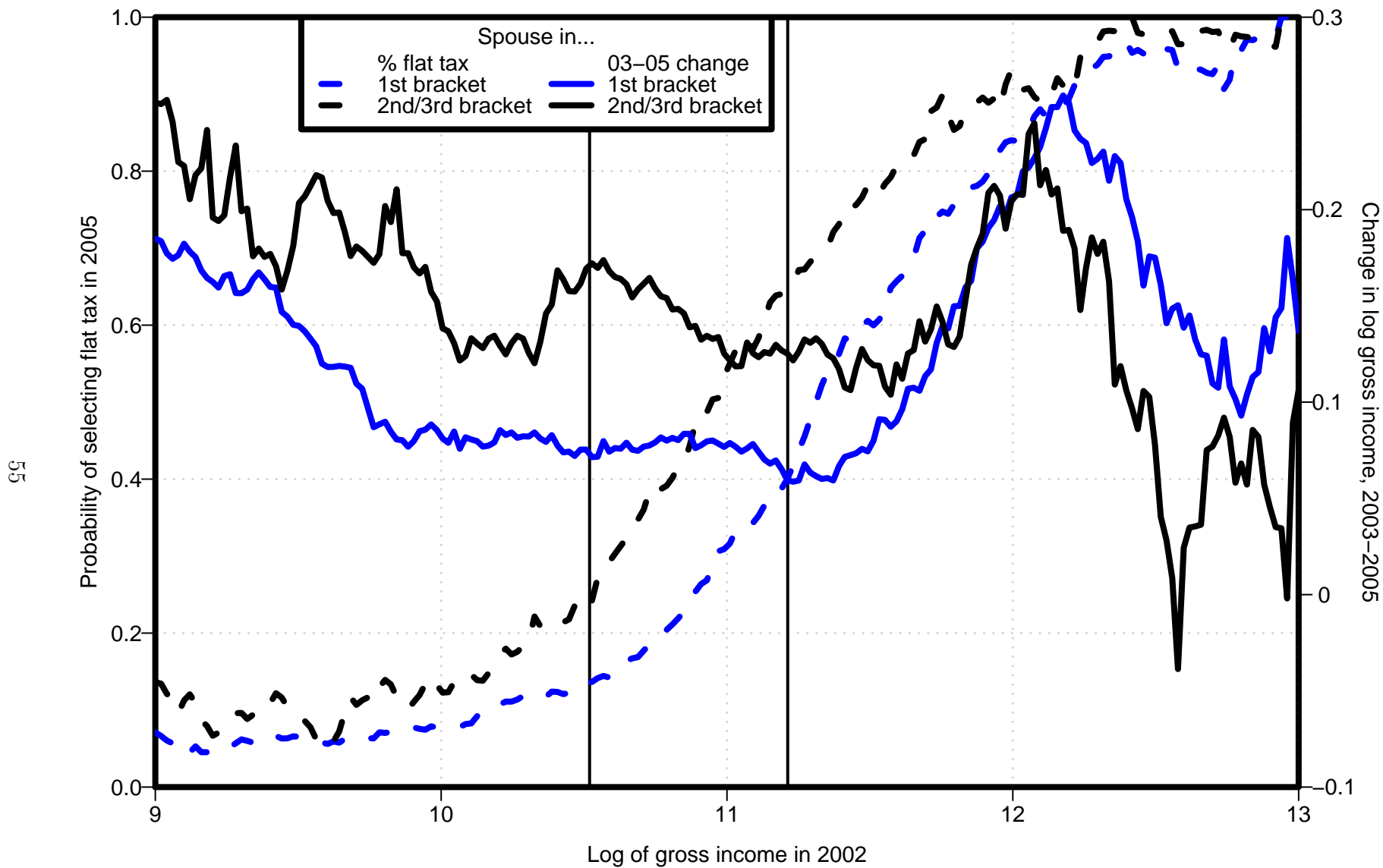


Figure 26: Flat tax and gross income change 2003-2005, conditional on having a spouse in a high tax bracket in 2002, business owners

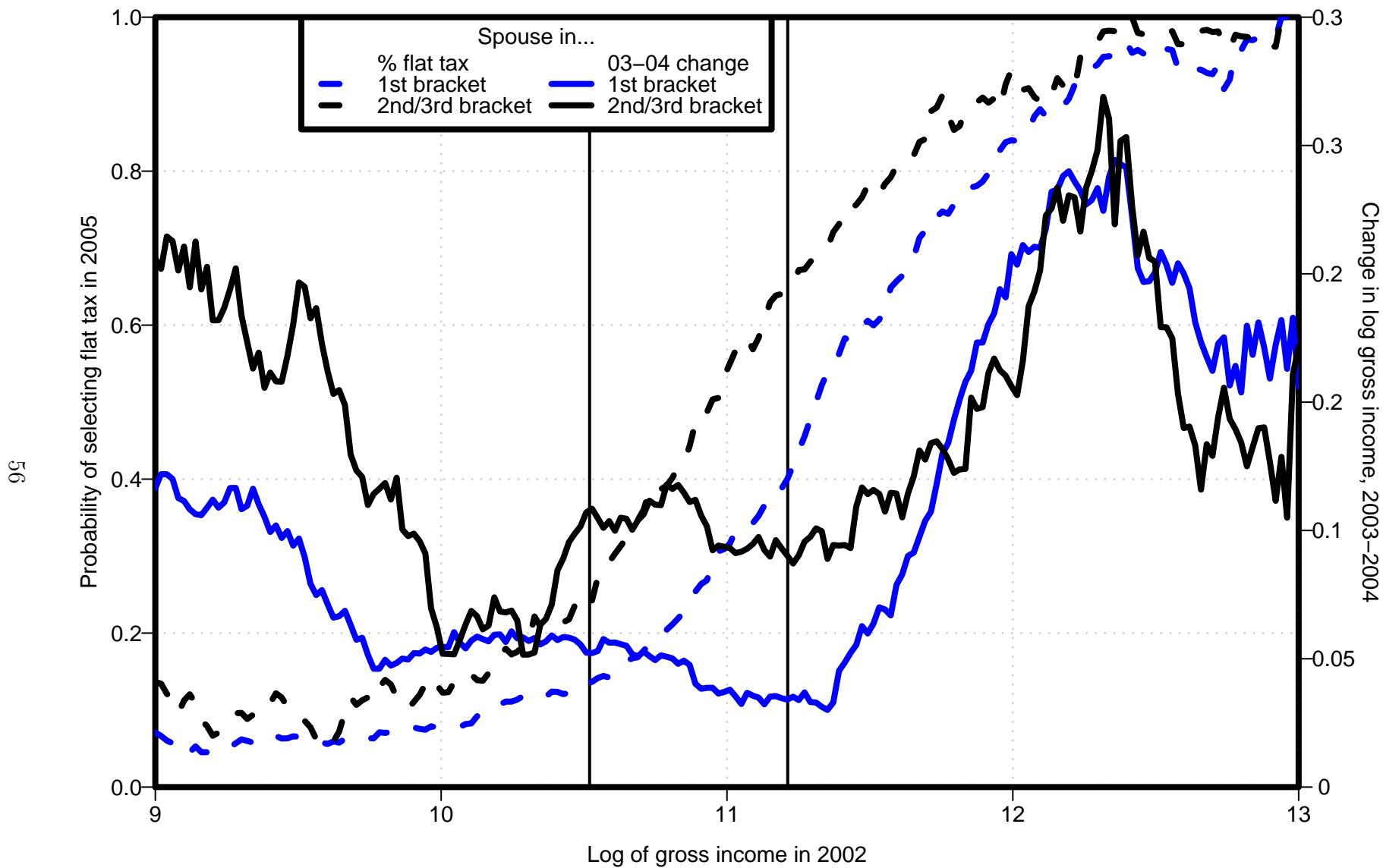


Figure 27: Flat tax and gross income change 2003-2004, conditional on having a spouse in a high tax bracket in 2002, business owners

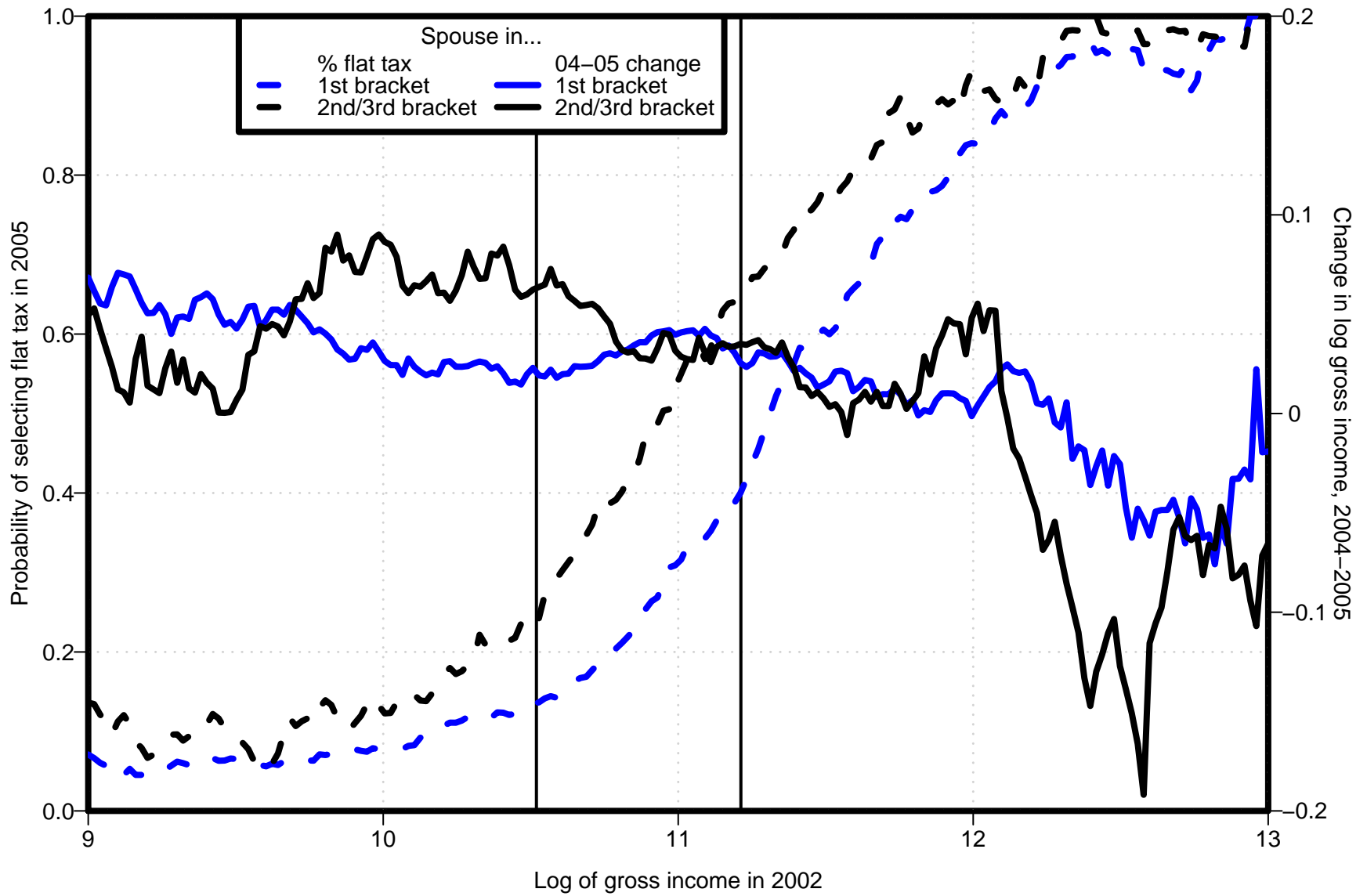


Figure 28: Flat tax and gross income change 2004-2005, conditional on having a spouse in a high tax bracket in 2002, business owners