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Has Debt Restructuring Facilitated Structural Transformation on Israeli Family Farms?

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Abstract

This paper analyzes structural transformation on Israeli family farms using longitudinal village-level data for the years 1992-2001, with particular emphasis on the effects of the 1985 debt crisis and the subsequent 1992 debt settlement legislation. Dynamic panel GMM estimation reveals a positive effect of reaching a debt restructuring agreement on farm size, of almost 9%. No significant effects were found on farm exits and on the shift to off-farm work. These micro-level effects are likely to be underestimated relative to the overall impact of the debt restructuring legislation.

Introduction

As in many other developed economies, the farm sector in Israel has experienced considerable structural changes over the last few decades. These included a massive exit of self-employed farm operators, an increase in the size of remaining farms, and an increase in off-farm labor participation among the farm population. The process of structural change has been accelerated by two major events: the debt crisis of 1985 and the opening of the country to foreign labor in the early 1990s. The effect of foreign workers on farm structure in Israel has been examined by Kislev (2003). In this paper I focus on the effects of the debt crisis and the subsequent legislation and implementation of a debt restructuring policy.

Before describing the debt crisis, I would like to motivate the discussion by establishing that the year 1985 can be viewed as an important point in the structural change process. Official data published by the Central Bureau of Statistics show that the number of self-employed in agriculture has decreased at an annual rate of 0.6% between 1955 and 1985, and this exit rate was almost 10 times higher between 1985 and 2002, at 5.6% annually. The quantity index of net product per farm has increased at an annual rate of 7.4% between 1955 and 1985, and at 10.6% annually between 1985 and 2002. The fraction of the labor force in Moshavim (cooperative villages) employed in agriculture has decreased from 73% in 1956 to 45% in 1985 (just under 1% annually), and to 15% in 2002 (1.8% annually between 1985 and 2002). It is by no means clear that the debt crisis alone was responsible for this structural break. Indeed, agriculture's terms of trade

decreased at an annual rate of 0.9% between 1952 and 1985, and at 1.2% between 1985 and 2002 (Kislev and Vaxin, 2003).

The debt crisis was triggered by the anti-inflationary government policy of 1985. During that year, inflation was reduced from an annual rate of over 500% to about 20%. The real rate of interest on agricultural debt, which was negative since the early 1970s, increased almost overnight up to 20% (Kislev, Lerman and Zusman, 1991). The balance sheet of agriculture in 1988 showed little if any equity (Kislev, 1993a). Before the crisis, farmers used to pay debt by taking new cheep loans. After the crisis, new credit could be raised at interest rates of 100% and even more. Under these conditions, there was no way in which the farm sector could continue to service its debt.

While the 1985 anti-inflationary policy was the trigger of the agricultural debt crisis, the roots of the crisis were planted decades earlier. The vast majority of pioneering farmers came to Israel with little or no assets, and had to rely on institutional provision of land and capital. Individual farms organized in local and regional cooperatives, the most important service of which was financial intermediation. As farmers cultivated mostly national land, they could not use their assets as collateral and lacked direct access to the capital market (Kislev, 2000). Cooperatives were able to borrow using mutual guaranties at various levels up to the national level. The political influence of agricultural cooperatives, which was way above their share in society, caused the government to bail them out of financial difficulties again and again, and this made the cooperatives preferred borrowers in the eyes of the banking system. Farmers did not take advantage of the negative interest rates of the 1970s in order to repay debt and increase equity. Rather, they continued to invest in farm capital, often to over-capacity, financed housing and infrastructure investments, and increased consumption. Altogether, all three parties, farmers, banks, and the government, shared the responsibility for the debt crisis.

While the government had an interest to rescue both agricultural cooperatives and commercial banks from collapsing, it could not simply take responsibility for the debt because of its volume - about $3.6 billion in 1988 - and because of the lack of public support for such action. What it could do is convince the banks to reach an agreement with the farmers on debt restructuring. The agreements signed in 1988-89 involved erasing almost a third of outstanding debt and rescheduling the remaining debt for 15 to

20 years, with positive but low real interest rates. Objectively, it wasn't feasible for the agricultural sector to meet its obligations even under these favorable terms (Kislev, 1993a, 1993b). Subjectively, the farmers expected to obtain better terms in the future, which turned out to be correct. As a result, the implementation of these debt restructuring arrangements was minimal.

In 1992 (which was an election year), two separate debt settlements were reached for the Kibbutz (collective farm) sector and the Moshav (cooperative village) sector. The core of the two settlements was similar: determining the level of debt, as of December 31, 1991, that is directly related to agricultural activity; assessing the income potential of farms and rescheduling the part of the debt deemed repayable; and forgiving the remaining debt (Kislev, 2000). The Moshav settlement took the form of a law enacted by parliament with support from both sides of the political spectrum. While the law did not entail public funds for direct debt repayment, it did provide for the establishment of a Debt Settlement Administration (hereafter DSA) that will oversee the implementation of the law. The purpose of the law was to enable Moshav farms to continue their production activity without being perpetually threatened by banks. The more detailed objectives were:

- Combining all legal processes standing against agricultural entities under one umbrella;
- Assessing the level of debt that resulted from agricultural activity up to the end of 1991;
- Negotiating a debt settlement agreement between each debtor and its creditors;
- Releasing farmers of their mutual financial guaranties for the debt of cooperatives;
- Promoting the rehabilitation rather than dissolution of agricultural entities.

The idea was that after reaching and implementing a debt restructuring agreement, farmers will be able to continue functioning and in particular will be able to obtain credit without being limited by their past debts. The implicit assumption was that without such credit, many farmers will be forced out of business. Two questions can be raised here: first, to what extent was the debt crisis responsible for the structural transformations in

Moshav farms; second, to what extent did the implementation of the debt settlement law change the direction and/or the pace of these structural transformations.

The purpose of this paper is to provide an empirical assessment of these questions. Three structural characteristics are examined, at the village level: the growth in aggregate farm production, the exit of individual farms from agricultural production, and the extent to which active farmers engage in non-farm employment. Two pivotal explanatory variables will be used: the size of the debt and the time of debt settlement agreement. The specific hypothesis is formally introduced in the following section. Next, the data sources are described. Subsequently, three levels of the empirical analysis are reported: a descriptive analysis, a multiple regression analysis, and a dynamic simultaneous model. The final section concludes with a summary of the findings and suggestions for further research.

Research Hypotheses

The null hypothesis is that neither the size of the debt nor the time of debt settlement agreement affects the structural outcomes. The alternative hypotheses are based on the presumption, expressed in the debt settlement law, that unsettled debt is a burden on farms. This implies that the higher the debt, the less profitable is agricultural production. Hence, higher debt will lead to slower farm growth, to a higher rate of exit and a higher tendency to engage in non-agricultural activities. Similarly, an earlier agreement of debt restructuring relaxes the burden of the debt, and hence is expected to lead to faster farm growth, lower rate of exit and a lower engagement in non-agricultural activities.

Data

The data used in this research come from two sources. The first source is an annual survey of agricultural activity that is conducted at the village level by the Ministry of Agriculture and the Central Bureau of Statistics. We have access to the data from 10 consecutive surveys, 1992 to 2001. The production data gathered is limited to the allocation of cropland to the different crops and the number of livestock. These are converted to gross value added using production norms based on 1995 data. We

aggregated specific crops and livestock into nine broader branches: beef, dairy, sheep, poultry, eggs, citrus fruits, other fruits, field crops and vegetables. The size of the farm is defined as the sum of value added of all nine branches. Since farm size is computed at the village level, using the village aggregate is similar to studying an average farm in each village. Besides farm size, the survey provides information on the number of active farms in each village, and on the fraction of active farm operators who engage in non-farm activities. While the survey provides information on all farm communities, our interest is on Moshavim only, and we have data for a total of 425 Moshavim out of 480. Data for the remaining 55 Moshavim were in bad shape and could not be used.

Figure 1 portrays the evolution of the three variables of interest over the survey period. Panel A shows the increase in farm size. The scales are logarithmic, so the slopes of the lines reflect rates of change. The bottom line (whose units are on the left-hand vertical axis) shows a modest increase in aggregate size (i.e. aggregate value added per village). The middle line shows a faster increase in the size of an average active farm, reflecting the decreasing number of active farms over time. The top line shows a roughly similar increase in the size of an average full-time equivalent farm (a part-time farm was counted as half of a full-time farm for this purpose), reflecting the fact that the fraction of part-time farms did not change dramatically over time. The units for the upper two lines are on the right-hand vertical axis. Panel B shows the decrease in the number of active farms (left vertical axis) and the change in the fraction of active farm operators who work off the farm (right vertical axis). This fraction is going up from 0.5 in 1992 to 0.53 in 1997 and then goes down to 0.52 in 2001. These changes are not remarkable in magnitude.

The second source of data is the 2004 annual report of the Debt Settlement Administration. The report includes several attributes of the debt restructuring process for each village. For our purposes, the relevant attributes are level of debt as determined by the DSA, and the year in which the settlement was agreed upon. The level of debt is reported for 375 of the villages in the survey. Note that there are 20 villages with zero debt, and for these there is naturally no year of settlement. There are 30 other villages with positive debt that have yet to reach an agreement. The distributions of the level of debt per farm and the year of settlement appear in figure 2. Note that the year of

settlement 1997, for example, includes settlements agreed upon in the second half of 1996 or in the first half of 1997. Hence, the low figure for 2005 includes in fact settlements agreed upon in the second half of 2004 only.

Descriptive results

We start the empirical analysis with a simple descriptive analysis of the association between structural characteristics and attributes of the debt restructuring. Figure 3 shows farm growth by quintiles of total debt. The figure includes growth between 1992 and 2000 and between 1993 and 2001, as well as over the whole sample period (1992 to 2001), in order to make sure that the findings are not caused by outlying observations in the beginning period or the final period. The figure shows a 5% overall growth rate in villages with debt, versus 15% growth in villages with no debt. However, within villages with debt, growth is higher in villages with larger debt, although the relationship is not necessarily linear. This is a counter-intuitive result. Perhaps the total debt captures the effect on growth of other conditioning variables.

Figure 4 shows farm growth by year of debt settlement. There seems to be a positive correlation between the two variables, although here as well the relationship is nonlinear. It is difficult to explain this pattern. One explanation that comes to mind after noting that the patterns in figures 3 and 4 are somewhat similar, is that the correlation between total debt and year of settlement is responsible for this pattern. Indeed, total debt and year of settlement are positively correlated. This can be because larger debts are more difficult to settle. To go around this correlation, the year of settlement was classified into early, intermediate and late settlements, within each quintile of total debt, so that the distribution across the three settlement "periods" was approximately uniform within each debt quintile. Figure 5 shows farm growth by settlement period. After controlling for the correlation between total debt and year of settlement, the positive association between growth and year of settlement is even more evident. This is also counter-intuitive. We will get back to this later when we use multiple regression to isolate marginal effects of these and other conditioning variables. Before that, we continue with other structural characteristics.

Figure 6 shows farm exit rates by debt quintile. Exit rates are higher among farms without debt than among farms with debt, but do not seem to change systematically with the size of the debt. As in the case of growth, perhaps total debt reflects other determinants of farm exit. For example, total debt may reflect intensive agricultural activity in the past, which may be due to favorable agricultural conditions or lack of alternatives, both can diminish the rate of farm exit. Figure 7 shows that there is no systematic association between exit rates and year of settlement. However, figure 8 shows that exit rates are higher in villages with later settlement periods relative to total debt. This result is more in line with our research hypotheses.

Figures 9-11 repeat the analysis for the case of the increase in the fraction of off-farm workers among active farm operators. There is no systematic association between total debt and the increase in the fraction of off-farm workers. The relationship seems to be nonlinear with respect to the year of debt settlement, with higher increases in off-farm work in the intermediate range of years, but when looking at periods of debt settlement relative to total debt, the relationship weakens and even disappears. It should be noted that the increase in the fraction of off-farm workers seems to be sensitive to outliers in the initial and final periods. Therefore, the robustness of the results with respect to initial and final periods will be verified in the subsequent regression analysis.

Regression results

In this section we report the results of regression analyses of the changes in structural characteristics over the sample period as functions of debt and the period of debt settlement agreement. Table 1 shows OLS regression results. The explanatory variable of debt per farm has been expressed alternatively in log form, in quadratic form, and as a set of quintile dummies, with no qualitative change in the results. Similarly, the ordered qualitative variable of debt settlement period has been expressed as a set of dummy indicators, with no change in the results. We have experimented with various additional control variables, including geographic location, village establishment year, and institutional affiliation, and only two dummy indicators turned our statistically significant in any regression, a dummy for villages established after 1960, and a dummy for location in the north. Hence, the table includes results with and without these two

variables. We have also verified that the results are not qualitatively sensitive to omitting the first year or the last year from the calculation of the dependent variables.

We observe that debt per farm does not have a significant effect on any of the structural characteristics, except for a positive effect on the increase in off-farm work that disappears after including the establishment year dummy. The period of debt settlement has a statistically significant positive effect on farm growth regardless of the inclusion of other controls, and this is true for the growth of output per farm, the growth of output per active farm, and the growth of output per full-time equivalent farm. The result that farms grow faster in villages that reach a debt-settlement agreement later is counter-intuitive, as we have claimed in the preceding section. This raises the question whether the period of debt settlement agreement is indeed exogenous to the growth process.

Exogeneity of the period of debt settlement agreement could be challenged on two grounds. Recall that it involves an agreement between debtors and creditors, namely farmers and banks, brokered by the DSA. In practice, though, it was the DSA that negotiated with farmers, while the banks were more or less passive. Let us consider first the role of farmers. Farmers had an incentive to postpone the agreement in the hope of better terms in the future, a hope that was based on past experience. Perhaps those farmers who were able to afford to postpone the agreement, conditional on the size of the debt, were those with favorable growth prospects. From the point of view of the debt settlement administrators, their goal was to help farmers get back on track, so they could have an incentive to deal first with those who seem to be most adversely affected by the burden of the debt, and to postpone dealing with farmers who seem to be in relatively good shape. The latter could be those with the better growth prospects. Both arguments could lead to a positive association between farm growth prospects and delayed debt settlement agreements.

To deal with the possible endogeneity of the period of debt settlement, one has to find proper instruments. It is difficult to think of variables that affect the tendency of farmers to postpone the debt settlement agreement and are independent of the growth prospects. However, an instrument that is correlated with the tendency of the DSA to postpone agreement may be available. Recall that cooperative villages were organized in secondary cooperatives, and the latter were deeply involved in financial intermediation

and hence in the creation of the debt (Kislev, 1993b). As a result, the work of the DSA has been organized by secondary cooperatives: each secondary cooperative was assigned an administrator that tried to negotiate debt settlements for all members of that cooperative. Hence, villages belonging to the same secondary cooperatives are likely to have their debt settled at approximately the same time, other things equal. This generates the necessary correlation between the period of debt settlement and the affiliation with a particular secondary cooperative. The question is whether membership in a particular secondary cooperative has anything to do with growth prospects of individual villages. We believe that the answer is no: our growth figures are for 1992-2001, way after the secondary cooperatives lost their role as financial intermediaries (Kislev, 1992). Hence, we use secondary cooperative membership as an instrument for the period of debt settlement.

The instrumental variable results are in table 2. Compared to the OLS results, the period of debt settlement still has a positive coefficient in the growth regressions, but this coefficient becomes insignificant in the aggregate growth regression and in the growth per full-time farm regression. It does remain statistically significant at the 5% level in the growth per active farm regression. In the farm exit regression, the period of debt settlement has a significant negative coefficient, but it becomes insignificant after including the north dummy. These results are not surprising, given the fact that our instruments - membership in secondary cooperatives - have a strong geographic element and are also associated with the year of village establishment. In addition, recall that we were not able to instrument for the tendency to postpone debt settlement from the side of the farmers. Hence, the instrumental variables results cast doubt on the positive association between farm growth and the period of debt settlement, but do not completely resolve the estimation problems.

Another possibility that comes to mind is that growth, exit and off-farm work are simultaneously determined, so that the separate estimation we conducted is in fact the reduced form. Weiss (1999) showed that farm size and farm survival are determined simultaneously, while Huffman and Evenson (2001), Yee, Ahearn and Huffman (2004) and Ahituv and Kimhi (2006) showed that farm size and off-farm labor are determined simultaneously, and Ahearn, Yee and Korb (2005) showed that all three structural

characteristics are determined simultaneously. This may explain some of the conflicting results above. For example, if a delay in debt settlement increases farm exits, more resources become available for remaining farms so that they can grow faster. In this case, we would observe, in the reduced form, a positive effect of the period of debt settlement on growth per active farm, whereas if we hold the number of active farms fixed we would not find any effect of the period of debt settlement. This calls for a simultaneous estimation of all three structural characteristics. Given the absence of proper cross-sectional instruments, this will be performed in a dynamic setting, as will be explained in the following section.

Dynamic simultaneous estimation

Estimation of a dynamic equation or system of equations requires longitudinal data. Hence, for this purpose we use the year-by-year values of the structural farm characteristics rather than the overall change over the entire period as before. The estimation method we adopt is the dynamic panel data GMM model of Arellano and Bond (1991). This model uses first differences to control for unobserved heterogeneity in the cross section, and corrects the resulting serial correlation using an appropriate transformation of the variance-covariance weighting matrix. Each equation is estimated separately, and lags of first differences of both endogenous and exogenous variables are used as instruments in the estimation. Combes, Magnac and Robin (2003) estimated a similar two-equation dynamic system to study changes in regional employment patterns in France, while Blien, Suedekum and Wolf (2005) applied a similar methodology to German data. Previous longitudinal studies of structural characteristics of the U.S. farm sector, including Huffman and Evenson (2001), Yee, Ahearn and Huffman (2004), Ahearn, Yee and Korb (2005) and others, were based on simultaneous estimation but did not explicitly account for the dynamics.

Specifically, the equations we estimate, at the village level, are:

$$(1) \quad \ln y_{it} = \alpha_0 + \alpha_1 \ln y_{it-1} + \alpha_2 x_{it} + \alpha_3 z_{it} + \alpha_4 w_{it} + D_i t\alpha_5 + \mu_{yi} + u_{yit}$$

$$(2) \quad x_{it} = \beta_0 + \beta_1 x_{it-1} + \beta_2 \ln y_{it} + \beta_3 z_{it} + \beta_4 w_{it} + D_i t\beta_5 + \mu_{xi} + u_{xit}$$

$$(3) \quad z_{it} = \gamma_0 + \gamma_1 z_{it-1} + \gamma_2 \ln y_{it} + \gamma_3 x_{it} + \gamma_4 w_{it} + D_i t\gamma_5 + \mu_{zi} + u_{zit}$$

where y is average farm size, x is the fraction of active farms, and z is the fraction of active farm operators who work off the farm. These are the endogenous structural farm characteristics. Also, w is a binary variable indicating whether the village has already signed the debt settlement agreement. This explanatory variable is also treated as endogenous. Because of the first differencing, time-invariant explanatory variables are multiplied by t (time). These variables include total debt (per farm), geographic region, year of establishment and number of farms in the village, and are arranged in the matrix D, along with a unit vector. The coefficient of this unit vector is the autonomous rate of change in the dependent variable, and the coefficients of the other time-invariant variables are shifts to this rate of change. The inclusion of a lagged dependent variable in each equation effectively controls for the long-run determinants of the dependent variables, hence the other explanatory variables only explain the short-run changes in the dependent variables.

After first differencing, equations (1)-(3) become:

$$(1)' \quad \Delta \ln y_{it} = \alpha_1 \Delta \ln y_{it-1} + \alpha_2 \Delta x_{it} + \alpha_3 \Delta z_{it} + \alpha_4 \Delta w_{it} + D_i \alpha_5 + \Delta u_{yit}$$

$$(2)' \quad \Delta x_{it} = \beta_1 \Delta x_{it-1} + \beta_2 \Delta \ln y_{it} + \beta_3 \Delta z_{it} + \beta_4 \Delta w_{it} + D_i \beta_5 + \Delta u_{xit}$$

$$(3)' \quad \Delta z_{it} = \gamma_1 \Delta z_{it-1} + \gamma_2 \Delta \ln y_{it} + \gamma_3 \Delta x_{it} + \gamma_4 \Delta w_{it} + D_i \gamma_5 + \Delta u_{zit}$$

where Δ indicates a first difference, e.g., $\Delta z_{it} = z_{it} - z_{it-1}$. Note that the intercepts and the unobserved heterogeneity coefficients have been dropped, and that D is no longer multiplied by t. The model is estimated in one stage (see Arellano and Bond 1991 for details), and robust standard errors are computed. We also test for the existence of second order serial correlation, which could make the lagged first differences inappropriate instruments.

The estimation results are shown in table 3. The χ^2 test statistics at the bottom of the table show that the coefficients are jointly significant as a set for each equation. The Arrelano-Bond test statistics show that serial correlation is not a problem in any of the equations. The first coefficient for each equation is that of the lagged dependent variable. These coefficients are all between zero and one and are strongly significant. This means that there is a nontrivial degree of persistence in all dependent variables. Convergence

cannot be determined solely on the basis of these coefficients, because of the autonomous rate of change that is allowed here. However, the coefficients of the lagged dependent variables hardly changed when the models were estimated without the autonomous rate of change, so the convergence of all dependent variables in the long run is supported by the results.

The cross-effects of the dependent variable are mostly insignificant, except for the negative effect of farm size on the fraction of active farmers working off the farm. This effect is in line with previous findings (e.g., Ahituv and Kimhi, 2006). Note that the earlier studies discussed above found stronger and more significant cross-effects, because they did not include the dynamic effect and hence measured long-run rather than short-run effects.

The effects of the debt and the debt settlement arrangement appear to be significant only in the farm size equation, but their significance depends on the inclusion of shifts in the autonomous rate of change. In particular, the existence of a debt settlement arrangement seems to contribute to farm growth, in contrast to the regression results reported in the previous section. Reaching an agreement could increase farm size by almost 9%. This suggests that reaching a debt settlement agreement has a positive impact on the ability of farmers to compete in the post-cooperative era. We could not identify significant changes in the impact of the debt settlement agreement over time, when we added years since signing the agreement as an explanatory variable.

The size of the debt (per-farm average) is allowed to affect the autonomous rate of change only, because it is time-invariant, and is also found to be marginally significant in the farm size equation only. In particular, farms with larger debt seem to grow faster, but the effect becomes smaller and insignificant after allowing other village attributes to shift the autonomous rate of farm growth. If this effect is indeed true, it is very difficult to explain. In a reduced-form setting, we could have said that larger agricultural-related debt is associated with higher production capacity that could lead to faster farm growth, but this explanation is not valid in our dynamic setting.

The fact that debt and debt settlement agreements were not found to affect farm exits may be a result of two separate effects going in opposite directions. We expected

debt settlement to slow the exit rate because it relaxes the financial burden of the unsettled debt. However, it should be noted that prior to reaching a debt settlement agreements, some farmers were constrained in their ability to perform institutional transactions such as the sale of the farm, so a possible effect of debt settlement could be to relax those institutional constraints and perhaps to speed farm exits. This explains why the observed net effect is not significantly different from zero. With respect to off-farm labor, there is an indirect effect of debt settlement through farm size: debt settlement increases farm size and this in turn reduces off-farm labor.

Summary and conclusions

This paper deals with the impact on structural transformation of Israeli family farms of the 1985 debt crisis and the subsequent 1992 debt settlement legislation. We have analyzed longitudinal village-level data on structural farm characteristics and debt settlement agreements for Moshavim (cooperative villages) for the years 1992-2001, using descriptive methods, multiple regression analysis, and a dynamic simultaneous model. The results are not always consistent across the different methods, and hence, although we treat the dynamic simultaneous results as the most reliable, there is still some doubt regarding their robustness. This is further exacerbated by the fact the effects of interest are only marginally significant. Having mentioned these qualifications upfront, we turn to the key finding that reaching a debt settlement agreement could increase farm size. This implies that the debt restructuring legislation accomplished its goal at least to some extent. Moreover, the actual impact of the legislation might be even more far-reaching, if we consider the fact that even for those villages in which the debt settlement agreements have been reached later or have not been reached by 2005, there were expectations that agreements will be reached at some time in the future. Without the legislation, the ability of farmers to continue functioning could have been hampered more severely than it appears in our results, because of the need to battle the banking system on top of all other difficulties.

There is definitely scope for further research into this issue. One aspect that was not dealt with in this research is the actual implementation of the debt settlement agreements. Anecdotal evidence suggests that levels of implementation varied considerably across cooperatives. In some cases agreements were signed but

subsequently not respected by farmers, and then had to be reconsidered and reworked by the DSA. In other cases, agreements included a portion of debt that was supposed to be repaid using the proceeds of future residential land sales. When land sales have been blocked or considerably delayed for legal or institutional reasons, those agreements collapsed or had to be suspended. The 2004 annual report of the DSA, which is the source of our data, includes such anecdotal evidence. We believe that obtaining the history of the debt settlement procedures for each cooperative, using earlier annual reports or alternative sources of information, could enable a more accurate examination of the impact of the debt settlement legislation on structural transformation in the family farm sector.

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Table 1. OLS regression results

Dependent variable	Intercept	Debt per farm	Period of debt settlem.	Estab. after 1960	North	R^2	F statistic
Aggregate growth rate (369 obs.)	-0.198** (-2.86)	0.0001 (0.51)	0.070** (3.47)			0.040	7.59**
	-0.197** (-2.93)	-0.0001 (-0.91)	0.061** (3.07)	0.325** (4.46)		0.089	11.94**
	-0.199** (-2.86)	0.0001 (0.52)	0.071** (3.38)		-0.008 (-0.12)	0.040	5.05**
	-0.197** (-2.92)	-0.0001 (-0.88)	0.061** (2.95)	0.325** (4.45)	0.0005 (0.01)	0.089	8.93**
Farm exit rate (366 obs.)	0.113 (1.48)	-0.0002 (-1.30)	0.015 (0.69)			0.005	0.88
	0.113 (1.52)	0.00005 (0.27)	0.026 (1.18)	-0.381** (-4.72)		0.062	8.03**
	0.090 (1.20)	-0.00005 (-0.26)	0.038 (1.69)		-0.283** (-3.90)	0.045	5.69**
	0.089 (1.21)	0.0002 (1.37)	0.051* (2.29)	-0.396** (-5.01)	-0.298** (-4.25)	0.107	10.82**
Increase in off-farm work (365 obs.)	0.007 (0.21)	0.0002* (2.51)	-0.003 (-0.32)			0.018	3.30*
	0.007 (0.22)	0.0001 (1.36)	-0.006 (-0.66)	0.112** (3.22)		0.045	5.72**
	0.010 (0.31)	0.0002* (2.10)	-0.006 (-0.64)		0.040 (1.26)	0.022	2.73*
	0.011 (0.33)	0.00008 (0.95)	-0.010 (-1.01)	0.114** (3.29)	0.044 (1.43)	0.051	4.81**
Growth per active farm (365 obs.)	0.058 (0.63)	-0.0003 (-1.45)	0.097** (3.56)			0.034	6.36**
	0.059 (0.63)	-0.0004 (-1.71)	0.094** (3.43)	0.105 (1.04)		0.037	4.61**
	0.033 (0.36)	-0.0001 (-0.54)	0.122** (4.39)		-0.304** (-3.44)	0.065	8.31*8
	0.034 (0.37)	-0.0002 (-0.80)	0.119** (4.26)	0.090 (0.090)	-0.300** (-3.39)	0.067	6.43**
Growth per full-time farm (365 obs.)	0.065 (0.72)	-0.0002 (-0.91)	0.095** (3.59)			0.035	6.51**
	0.066 (0.73)	-0.003 (-1.46)	0.090** (3.39)	0.182 (1.86)		0.044	5.52**
	0.042 (0.47)	-0.00001 (-0.06)	0.118** (4.36)		-0.278** (-3.23)	0.062	7.92**
	0.043 (0.48)	-0.0001 (-0.61)	0.113** (4.15)	0.168 (1.74)	-0.271** (-3.16)	0.070	6.73**

Notes: * significant at 5%. ** significant at 1%.

Table 2. IV regression results

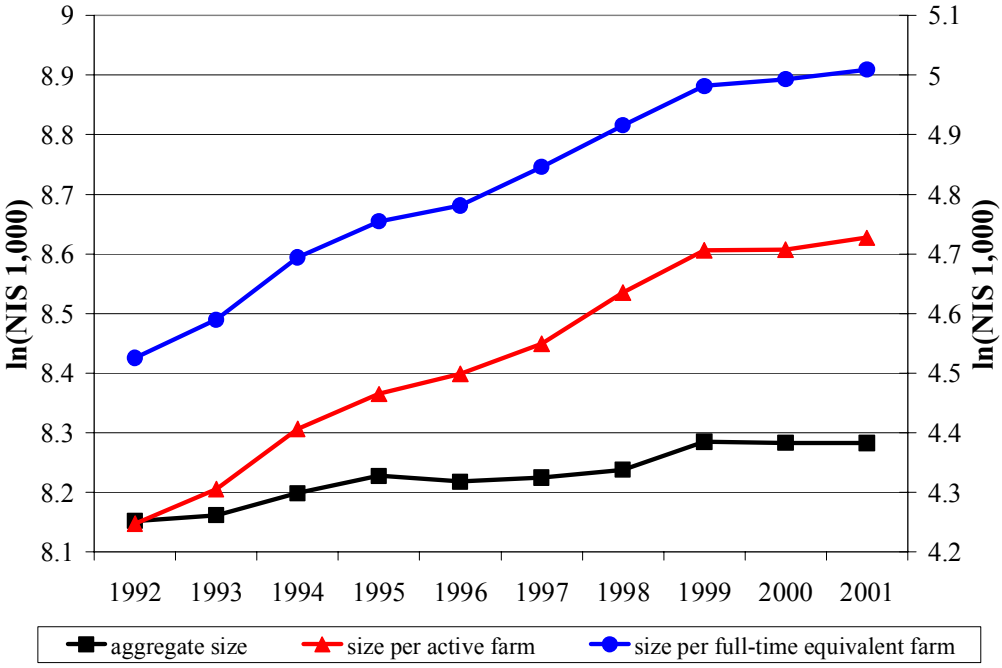
Dependent variable	Intercept	Debt per farm	Period of debt settlem.	Estab. after 1960	North	R^2	F statistic
Aggregate growth rate (369 obs.)	-0.489** (-3.14)	-0.0002 (-1.01)	0.167** (3.28)			0.188	8.22**
	-0.402** (-2.68)	-0.0003 (-1.78)	0.130** (2.68)	0.298** (3.63)		0.173	8.98**
	-0.592** (-2.60)	-0.0002 (-0.90)	0.209** (2.58)		-0.124 (-1.26)	0.270	4.46**
	-0.408 (-1.48)	-0.0003 (-1.44)	0.135 (1.71)	0.296** (3.37)	-0.062 (-0.64)	0.176	6.30**
Farm exit rate (366 obs.)	0.598** (3.80)	0.0002 (0.83)	-0.146* (-2.56)			0.139	7.36**
	0.505** (3.73)	0.0004 (1.26)	-0.106* (-2.37)	-0.332* (-2.07)		0.139	7.18**
	0.454* (2.16)	0.0002 (0.64)	-0.088 (-1.77)		-0.178* (-1.98)	0.089	6.45**
	0.201 (1.23)	0.0003 (0.97)	0.011 (0.20)	-0.381* (-2.39)	-0.265* (-2.33)	0.110	6.33**
Increase in off-farm work (365 obs.)	-0.002 (-0.02)	0.0002 (1.76)	-0.0002 (-0.01)			0.004	2.90
	0.030 (0.40)	0.0001 (1.23)	-0.014 (-0.55)	0.115* (2.43)		0.011	3.56*
	-0.033 (-0.34)	0.0001 (1.24)	0.009 (0.26)		0.027 (0.63)	0.005	2.70*
	0.044 (0.43)	0.00009 (0.92)	-0.022 (-0.60)	0.119* (2.37)	0.054 (1.20)	0.013	2.88*
Growth per active farm (365 obs.)	0.266 (1.30)	-0.0001 (-0.55)	0.028 (0.41)			0.005	0.15
	0.322 (1.61)	-0.002 (-0.71)	0.05 (0.08)	0.139 (1.19)		0.010	0.51
	-0.247 (-0.90)	-0.0003 (-1.24)	0.220* (2.24)		-0.386** (-3.25)	0.311	3.61*
	-0.211 (-0.74)	-0.0003 (-1.27)	0.206* (1.99)	0.056 (0.44)	-0.373** (-2.86)	0.281	3.42**
Growth per full-time farm (365 obs.)	0.267 (1.36)	-0.00001 (-0.04)	0.028 (0.43)			0.005	0.20
	0.345 (1.77)	-0.0001 (-0.40)	-0.004 (-0.06)	0.218 (1.89)		0.022	1.22
	-0.273 (-1.01)	-0.0002 (-0.90)	0.228* (2.34)		-0.370** (-3.12)	0.328	3.28*
	-0.184 (-0.66)	-0.0003 (-1.05)	0.193 (1.92)	0.136 (1.11)	-0.339** (-2.68)	0.259	3.41**

Notes: Huber-White robust standard errors are used. R^2 are calculated using true values of the period of debt settlement. * significant at 5%. ** significant at 1%.

Table 3. Dynamic panel GMM results

Explanatory Variable	Average Farm Size		Fraction Active Farms		Fraction Working Off-Farm	
Endogenous						
Lagged average farm size	0.4238** (6.24)	0.4369** (6.30)				
Lagged fraction active farms			0.5536** (8.15)	0.5103** (6.90)		
Lagged fraction working off-farm					0.6239** (10.23)	0.6209** (10.21)
Average farm size			-0.0221 (-0.57)	-0.0348 (-0.91)	-0.0936** (-2.84)	-0.0938** (-2.80)
Fraction active farms	0.0179 (0.12)	-0.0672 (-0.42)			-0.0795 (-1.08)	-0.1175 (-1.60)
Fraction working off-farm	-0.0450 (-0.27)	-0.0493 (-0.29)	-0.0126 (-0.19)	-0.0392 (-0.56)		
Debt settlement agreement (yes/no)	0.0885* (2.14)	0.0810 (1.79)	0.0194 (0.95)	0.0292 (1.40)	-0.0029 (-0.17)	0.0029 (0.16)
Rate of change						
Average debt	0.00003 (1.92)	0.00005** (2.90)	-0.00001 (-1.26)	0.000009 (1.27)	-0.000007 (0.82)	0.00001 (1.74)
North	-0.0060 (-0.82)		0.0133** (3.14)		0.0017 (0.58)	
South	-0.0080 (-1.19)		-0.0013 (-0.52)		-0.0011 (-0.42)	
Established up to 1948	0.0003 (0.05)		-0.0053 (-1.86)		-0.0025 (-0.86)	
Established after 1960	0.0154 (1.75)		0.0018 (0.33)		0.0041 (1.02)	
Number of farms	-0.0003 (-1.80)		-0.00002 (-0.28)		-0.000002 (-0.03)	
Intercept	0.0157 (0.98)	-0.0132* (-2.35)	-0.0063 (-0.88)	-0.0094** (-3.48)	-0.0025 (-0.41)	-0.0041 (-1.56)
Test statistics						
χ^2 statistic	86.00**	64.85**	167.66**	57.29**	125.54**	120.83**
Arellano-Bond test statistic	-0.20	-0.13	1.09	1.07	0.27	0.27

A. Logarithmic changes in aggregate size, size per active farm, and size per full-time equivalent farm



B. Number of active farms and fraction of active farm operators working off the farm

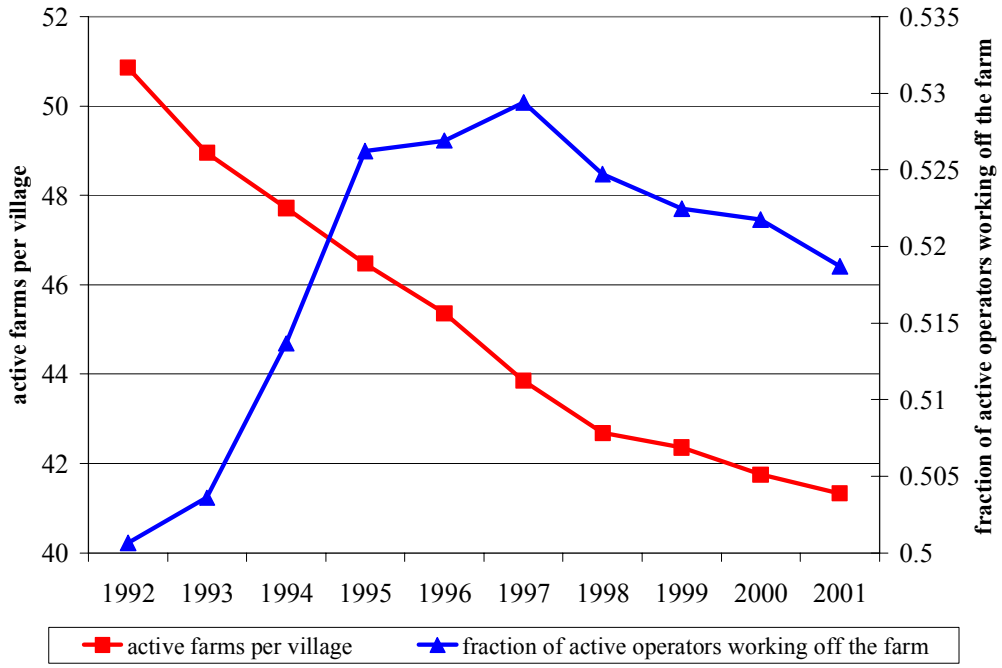
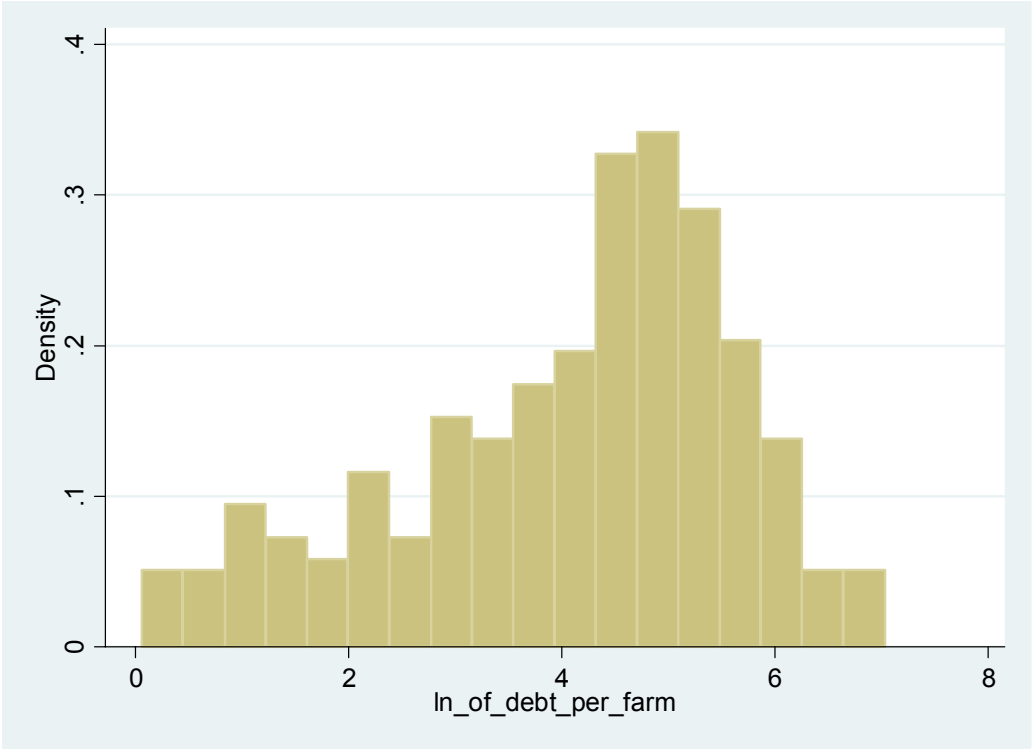


Figure 1. Evolution of structural characteristics

A. Logarithmic histogram of the level of debt



B. Distribution of year of settlement

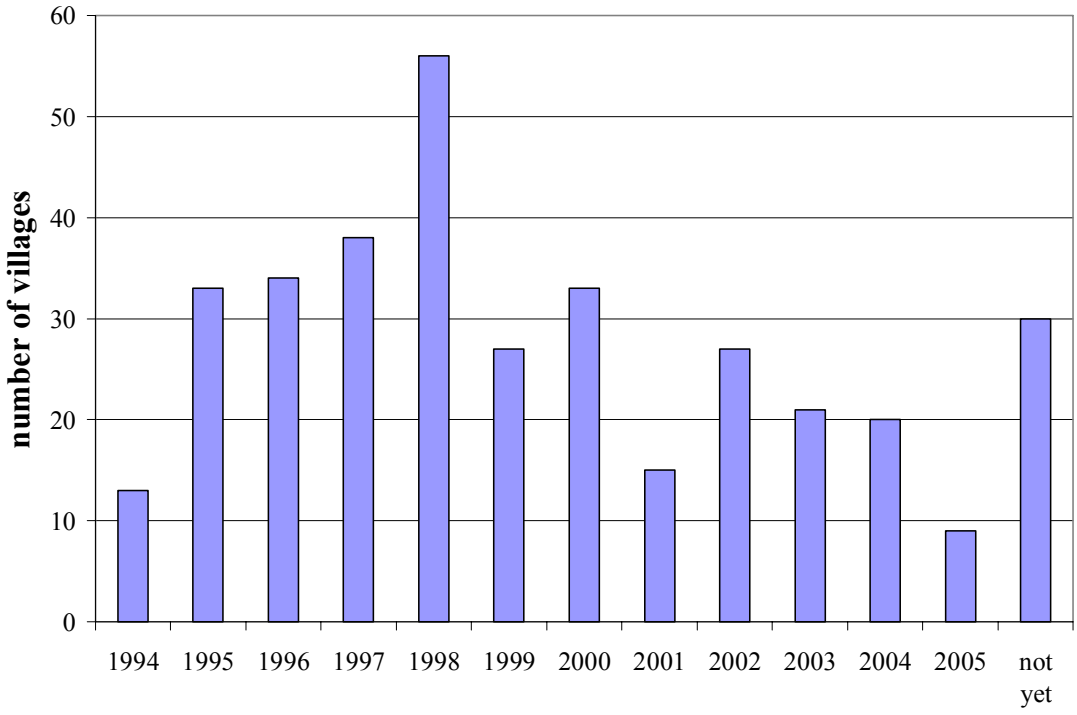


Figure 2. Debt and debt settlement characteristics

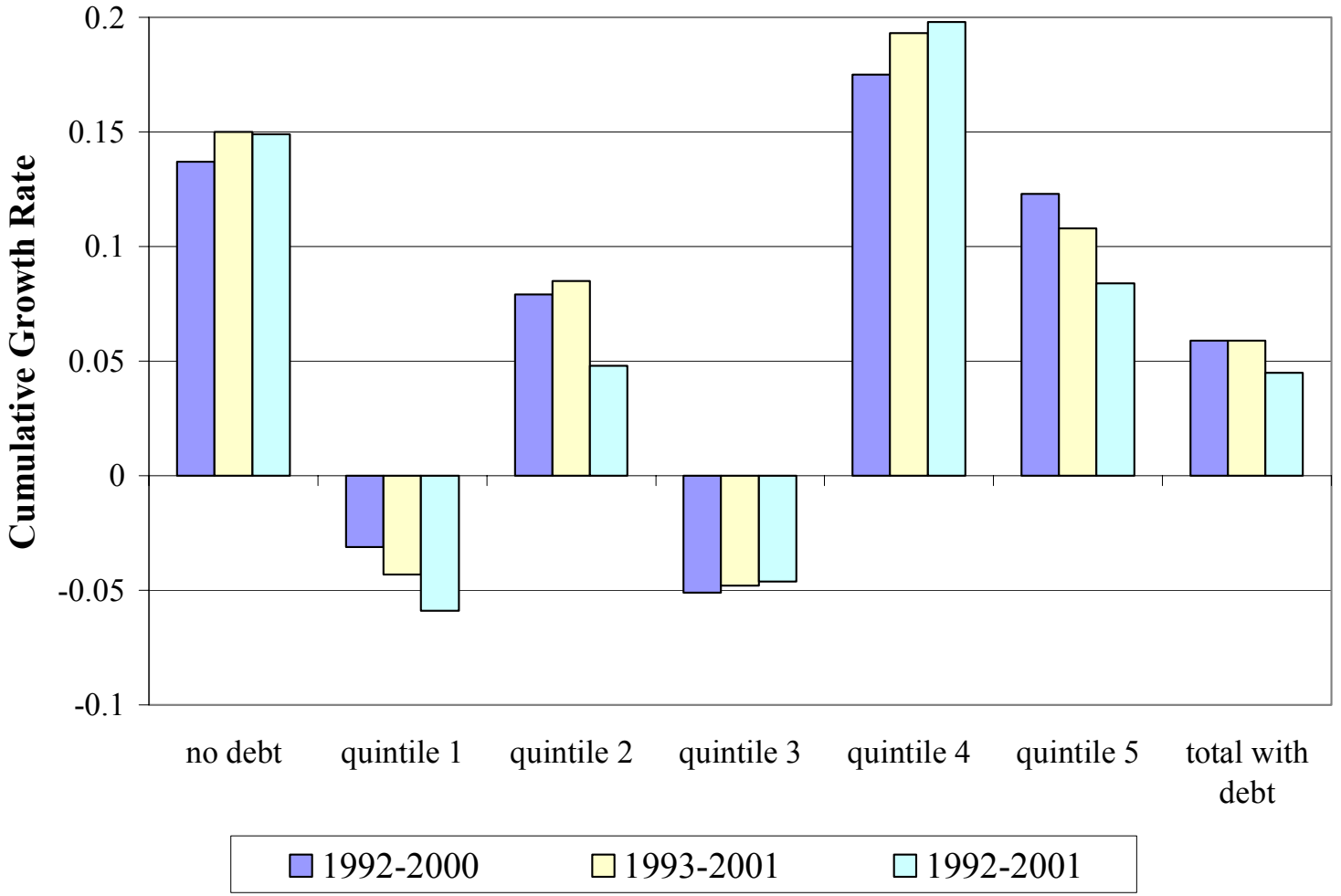


Figure 3. Farm growth by debt quintile

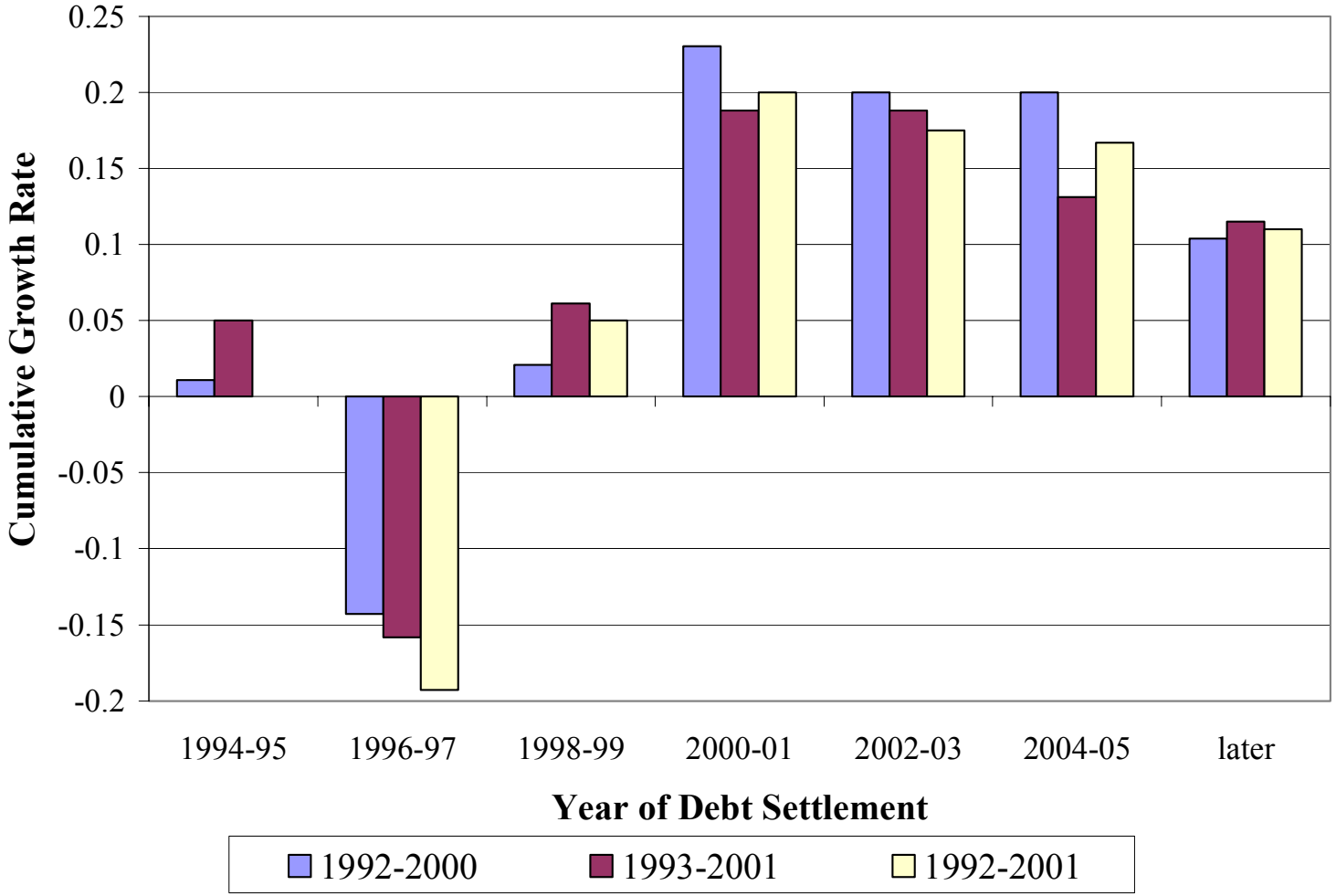


Figure 4. Farm growth by year of debt settlement

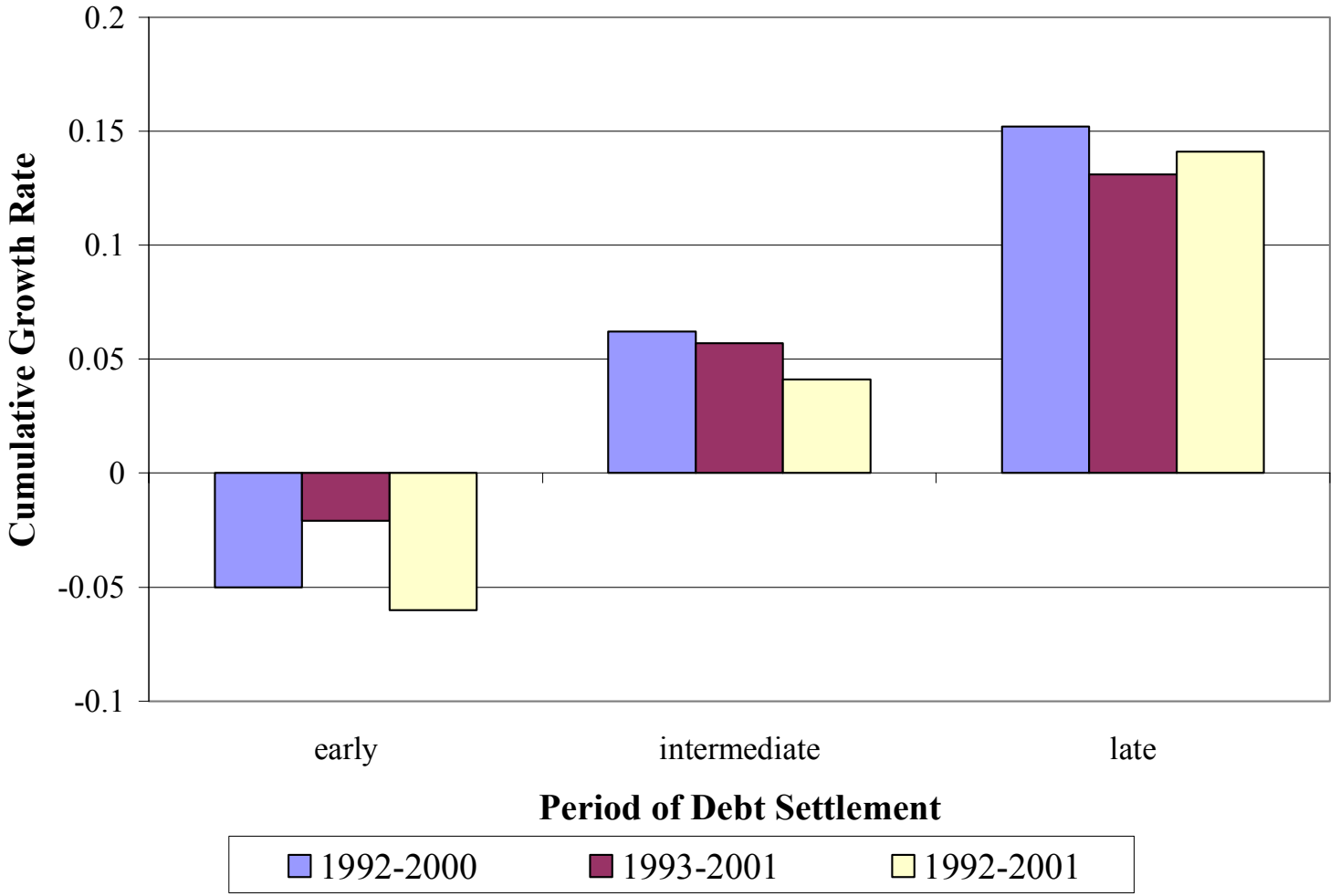


Figure 5. Farm growth by period of debt settlement

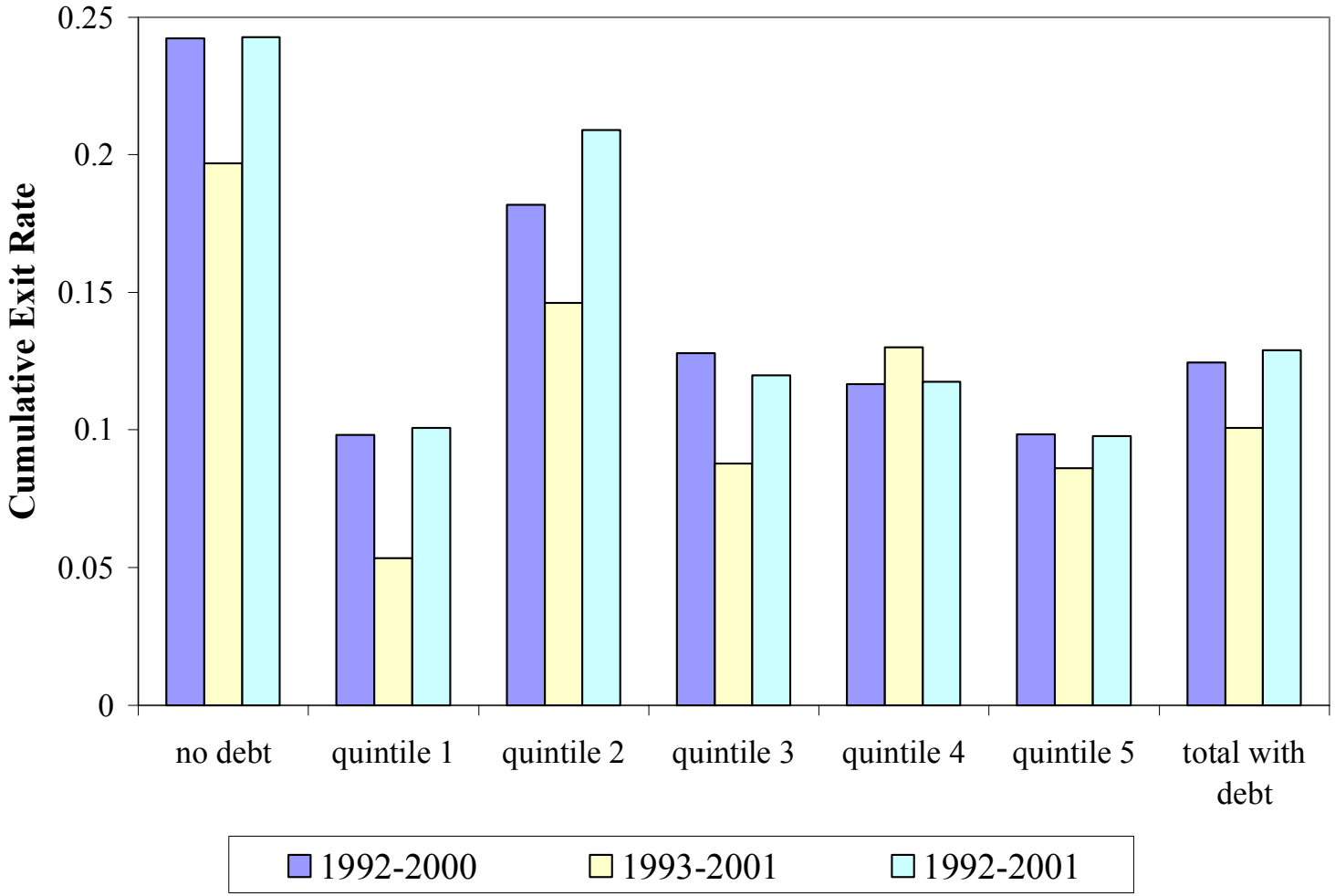


Figure 6. Farm exit by debt quintile

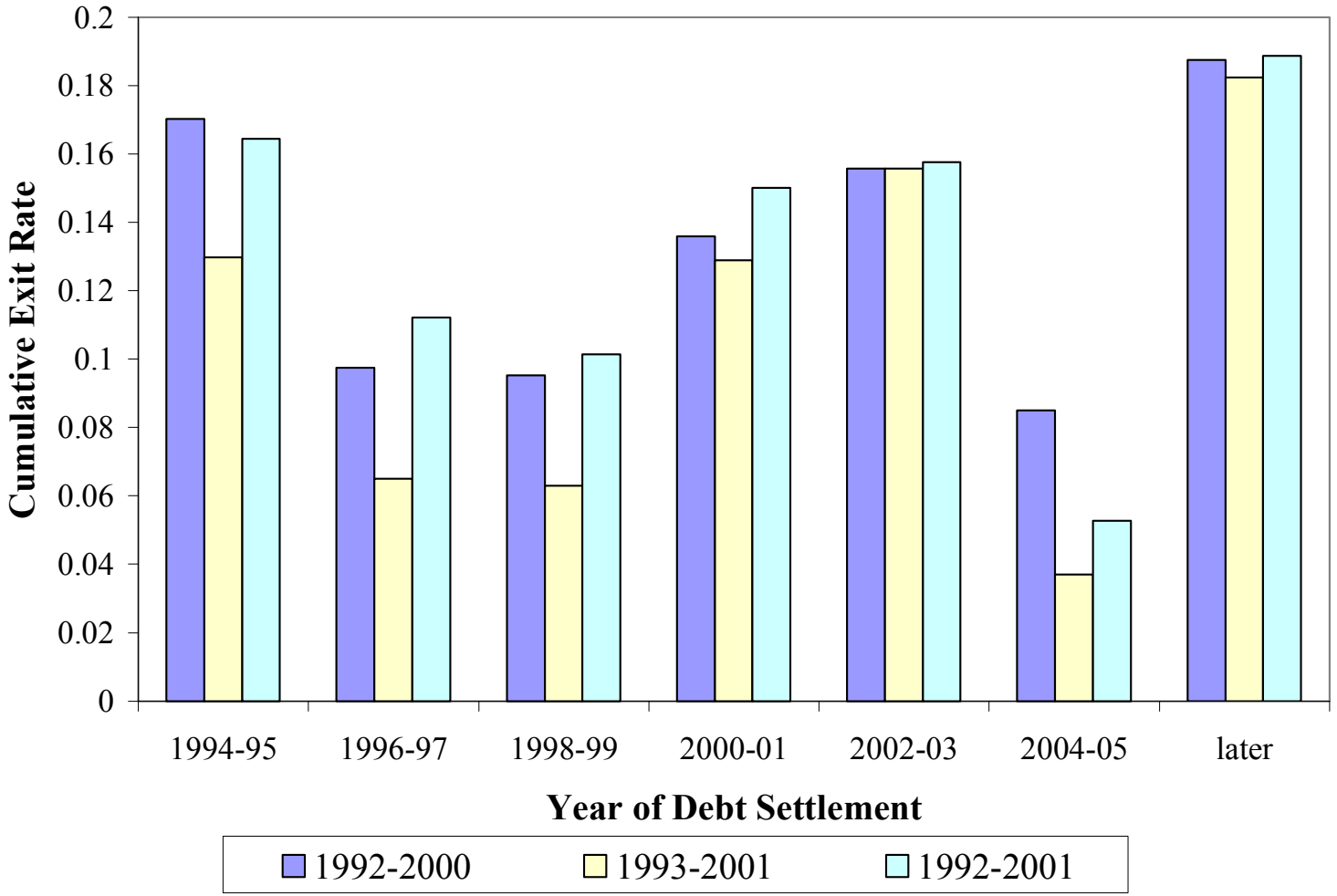


Figure 7. Farm exit by year of debt settlement

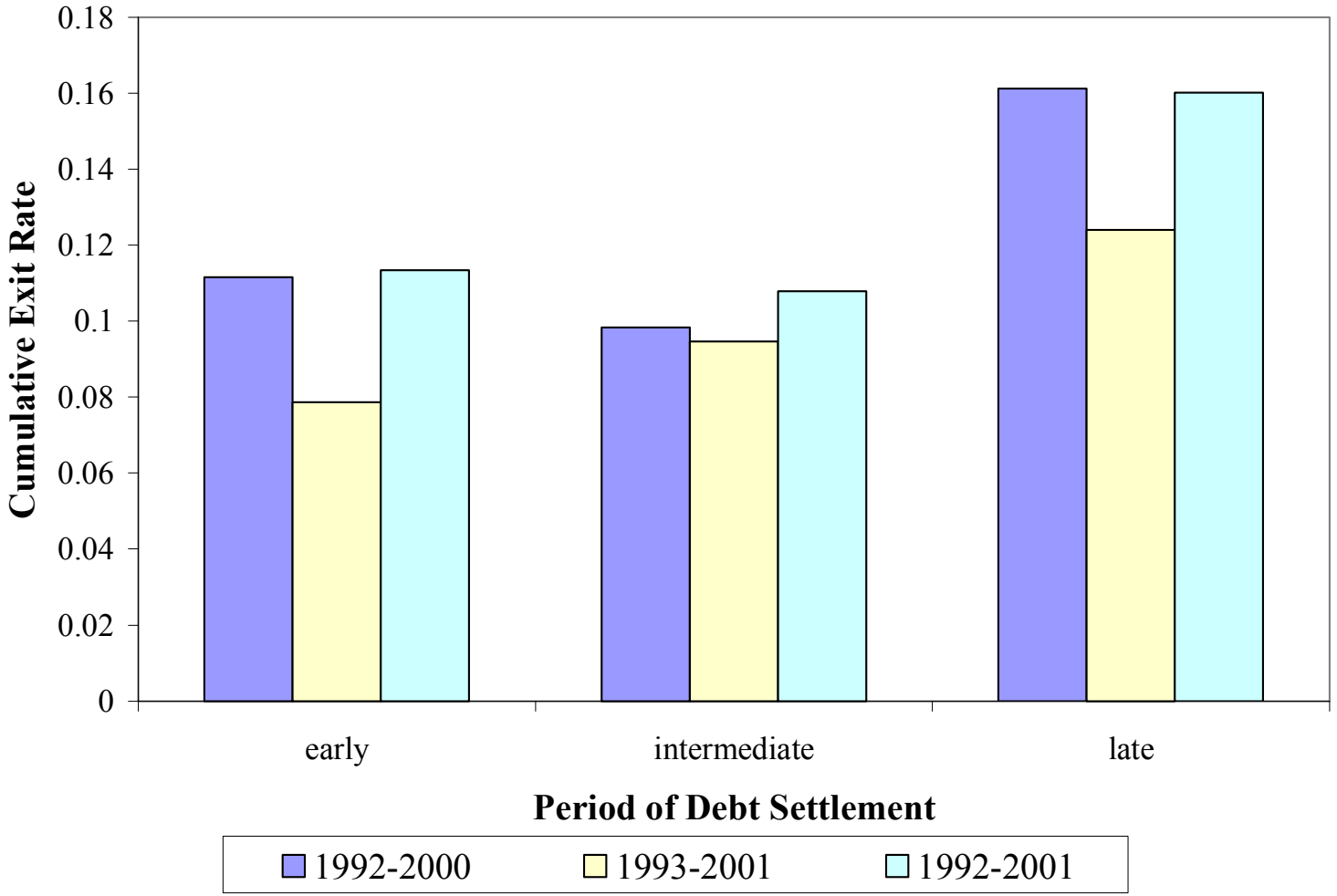


Figure 8. Farm exit by period of debt settlement

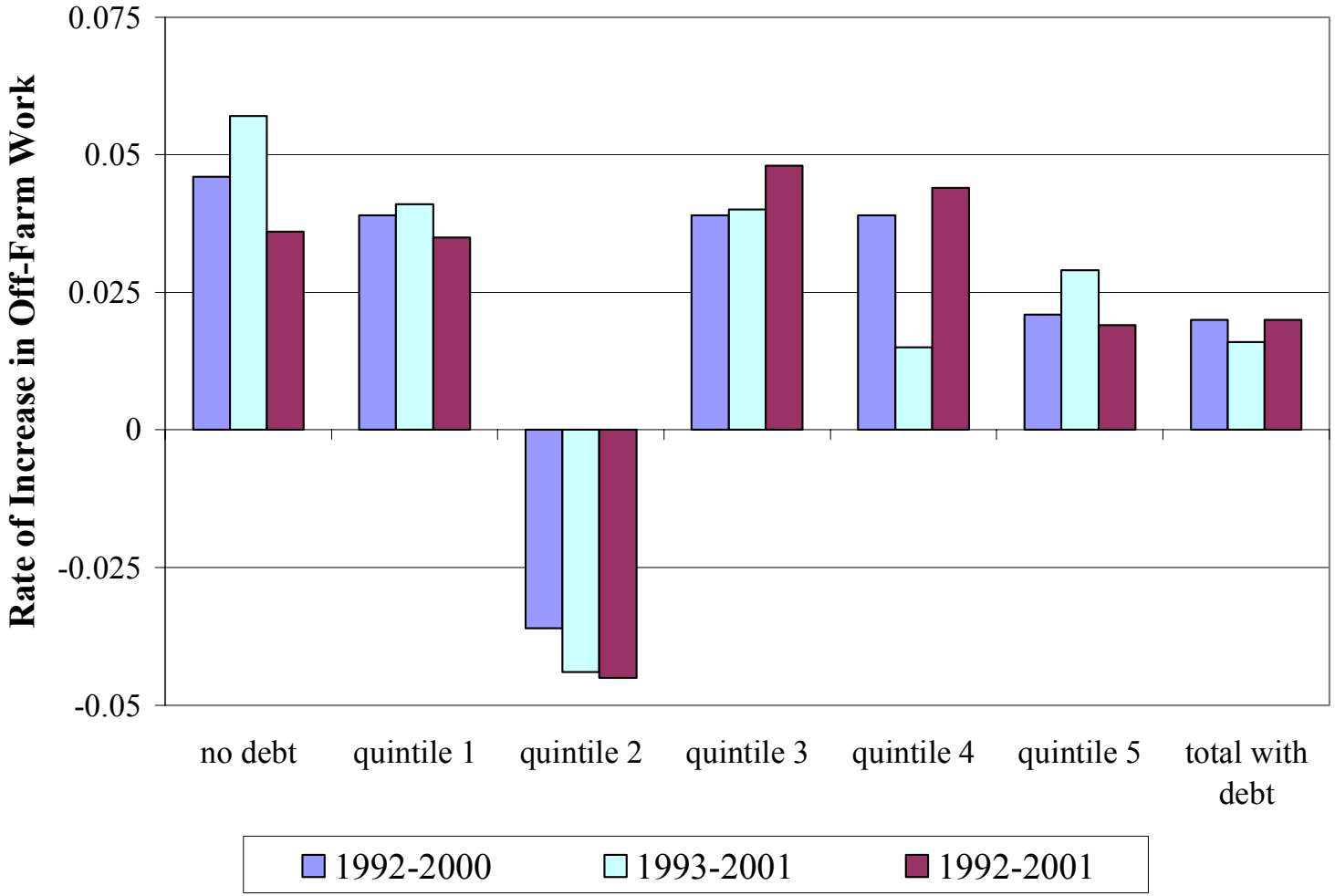


Figure 9. Rate of increase in off-farm work by debt quintile

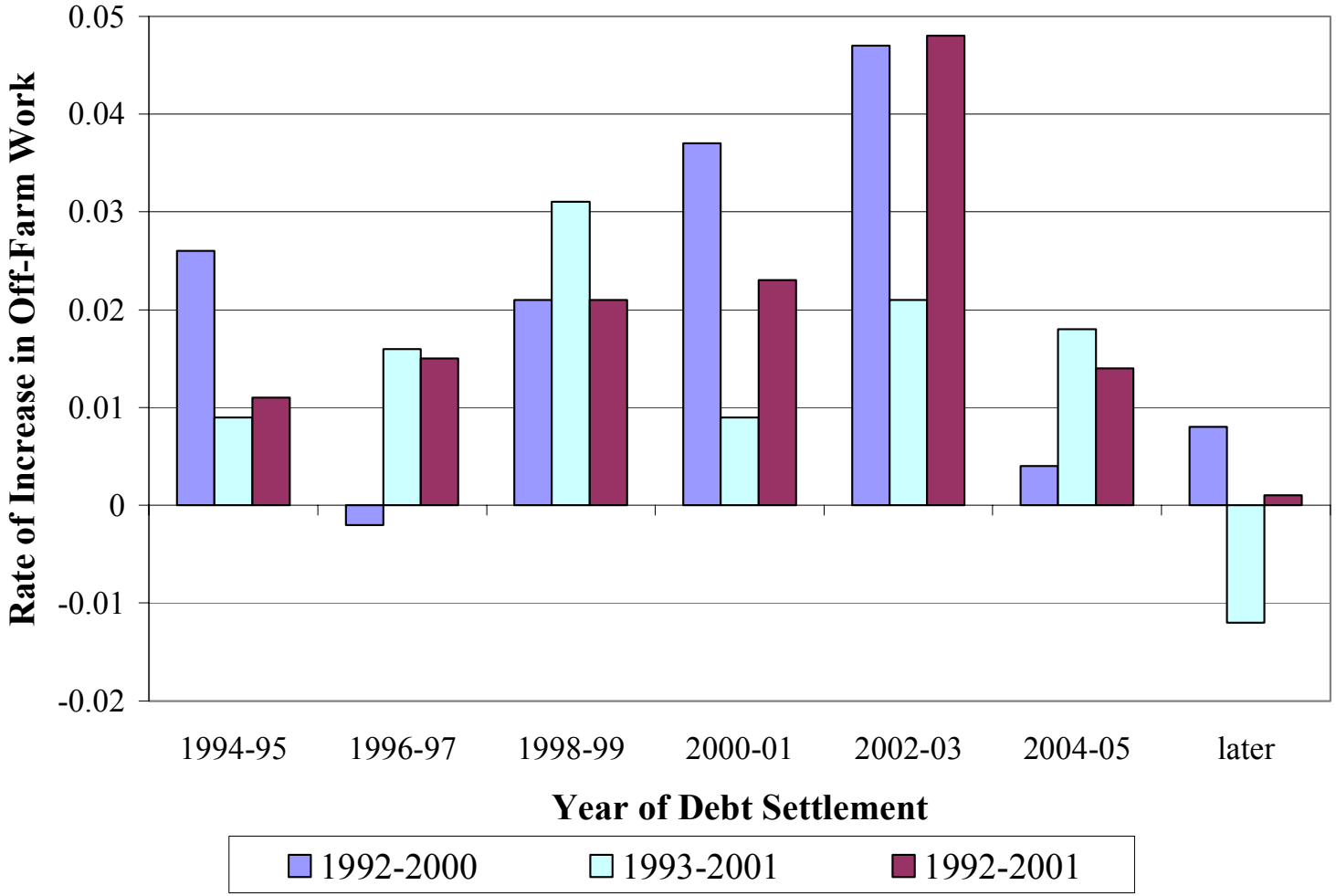


Figure 10. Rate of increase in off-farm work by year of debt settlement

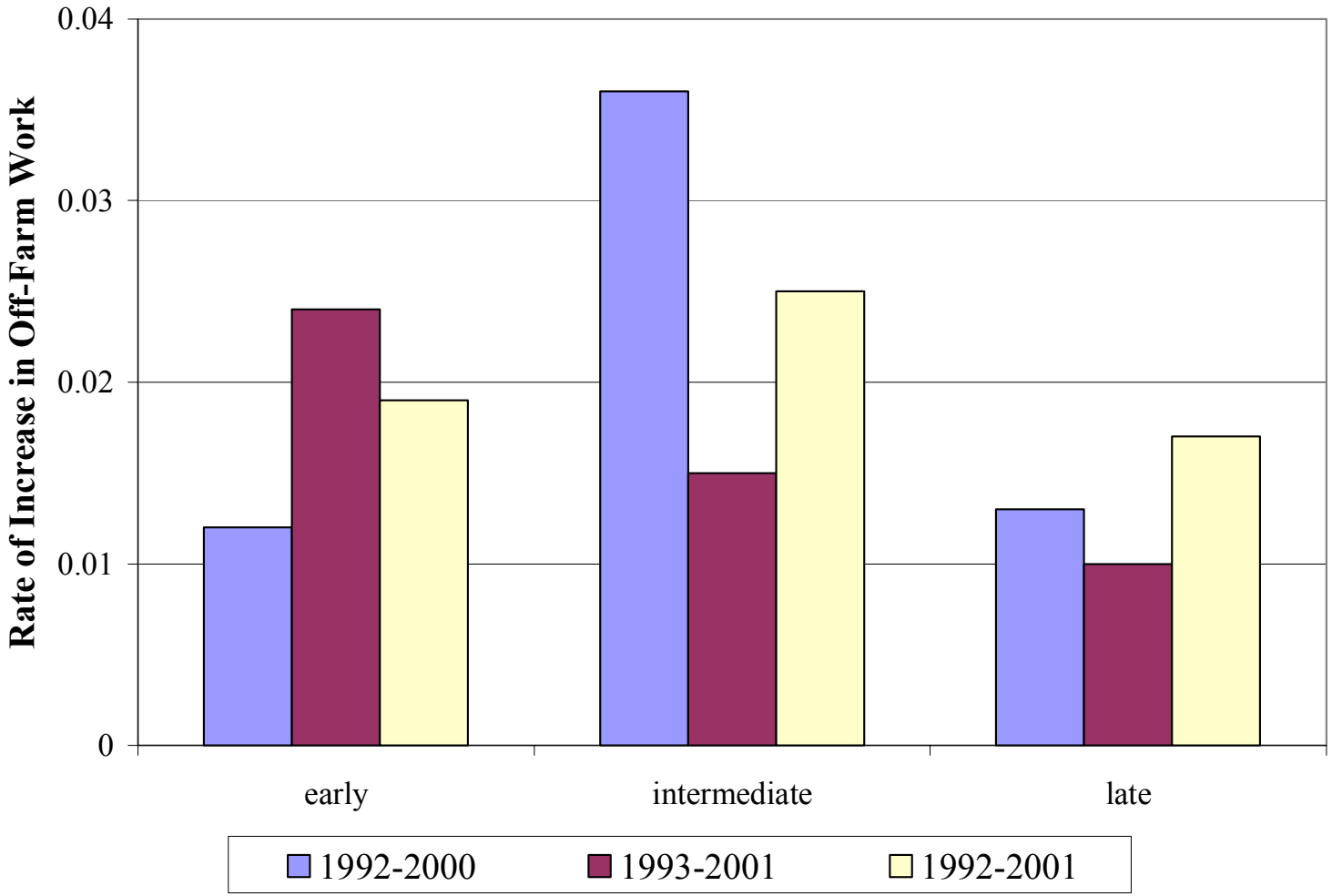


Figure 11. Rate of increase in off-farm work by period of debt settlement