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DISCUSSION PAPER

Institute of Agricultural Development in Central and Eastern Europe

WHAT KIND OF CROP INSURANCE FOR RUSSIA?

ANDREAS WILDERMUTH

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Magdeburger Straße 1, D-06112 Halle (Saale), Germany

Phone: +49-345-500 81 11

Fax: +49-345-512 65 99

E-mail: iamo@iamo.uni-halle.de

Internet: <http://www.landw.uni-halle.de/iamo/iamo.htm>

Dr. Andreas WILDERMUTH is research scholar at the Institute of Agricultural Development in Central and Eastern Europe (IAMO), Division: External Environment for Agriculture and Policy Analysis, in Halle, Germany. His research mainly focuses on agricultural insurance and rural finance.

Mailing address: Institute of Agricultural Development in Central and Eastern Europe (IAMO)
Magdeburger Straße 1
D-06112 Halle/Saale
Germany

Phone: +49-345-500 81 16

Fax: +49-345-512 65 99

E-mail: wildermuth@iamo.uni-halle.de

Internet: <http://www.landw.uni-halle.de/iamo/iamo.htm>

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Prof. Dr. Monika Hartmann (IAMO)

Prof. Dr. Dr. h.c. Peter Tillack (IAMO)

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ABSTRACT

The paper starts with an analysis of the decline of Russian state-subsidised all-risk crop insurance during the transition period, describes the reorganisation of Russian crop insurance started in 1997 and 1998, and compares the Russian experience with the Czech Republic's strictly commercial approach to crop insurance reform. A discussion of the pros and cons of multiple-peril/all-risk crop insurance yields the result that there is no allocative justification for subsidised all-risk and multiple-peril crop insurance. The subsequent discussion of alternative approaches to the design of crop insurance vindicates the Czech approach in so far as coverage is restricted to a limited number of perils. But this does not necessarily mean that the government should in all circumstances abstain from intervention in crop insurance markets. Under certain conditions compulsory insurance and subsidies can contribute to an increase in social welfare. The conclusion for Russia is that the present subsidised all-risk crop insurance scheme should be abolished and replaced with specific-risk crop insurance which offers coverage for a limited number of perils. A potential example would be insurance against the risk of yield losses by the hot and dry steppe wind *sukhovei*. The if and how of government intervention in crop insurance should be decided pragmatically, depending on the circumstances of the peril under consideration.

ZUSAMMENFASSUNG

Das Papier beginnt mit der Analyse des Niedergangs der russischen staatlich subventionierten All-Gefahren-Ertragsausfallversicherung in der Transformationsperiode, stellt die in den Jahren 1997 und 1998 angelaufene Reorganisation der russischen Ernteversicherung dar und vergleicht die Erfahrungen in Rußland mit dem strikt kommerziellen Ansatz der Tschechischen Republik zur Reform der Ertragsausfallversicherung. Eine Diskussion des Für und Wider von Vielgefahren-/Allgefahren-Ertragsausfallversicherungen führt zu dem Ergebnis, daß es keine allokativen Rechtfertigung für die subventionierte Allgefahren/Vielgefahren-Ertragsausfallversicherung gibt. Im Anschluß werden alternative Formen der Ausgestaltung von Agrarversicherungssystemen diskutiert. Diese Analyse bestätigt die Richtigkeit des tschechischen Ansatzes insoweit, daß die Deckung auf eine eng begrenzte Zahl von Gefahren beschränkt ist. Aber das heißt nicht notwendigerweise, daß der Staat unter allen Umständen von der Intervention in den Märkten für Ertragsausfallversicherungen absehen sollte. Unter bestimmten Bedingungen können Pflichtversicherung und Subventionen zu einem Zuwachs an sozialer Wohlfahrt führen. Die Konklusion für Rußland besteht darin, daß die gegenwärtige subventionierte Allgefahren-Ertragsausfallversicherung abgeschafft und durch eine Spezielle-Gefahren-Versicherung ersetzt werden sollte, die nur eine begrenzte Zahl von Gefahren abdeckt. Ein mögliches Beispiel wäre eine Versicherung gegen das Risiko von Ernteverlusten durch den heißtrockenen Steppenwind *Suchovej*. Das Ob und Wie staatlicher Eingriffe in die Ertragsausfallversicherung sollte pragmatisch und in Abhängigkeit vom konkreten Fall gesehen werden.

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1 INTRODUCTION

Agricultural production throughout the world is exposed to the risk of major production losses caused by natural hazards like hail, storm, flood, drought, or animal diseases, to name but a few. The extreme continental climate and the extension of agricultural production to marginal production areas during the period of central planning have increased the incidence of such risks in Russia. The drought, which was a major cause of the severe decline in agricultural crop production in 1998, exemplifies the significance of the problem. Since the risks associated with natural hazards often exhibit a strong positive correlation across farms in one region, the price mechanism may provide a partial hedge. But this need not be the case, if the degree of market integration is high and if transport costs for agricultural produce are relatively low.

It is beyond the scope of this paper to deal with all branches of Russian agricultural insurance, which comprises crop insurance and livestock insurance. Instead, we will concentrate on crop insurance. We will do this for two reasons. First, since the termination of compulsory agricultural insurance on 1st January 1991, crop insurance has experienced a stronger decline than livestock insurance. Second, the Russian government's policies regarding crop insurance are much more controversial than those for livestock insurance. There is nothing problematic about insuring livestock against contagious diseases. On the other hand, we will show in this paper that the present approach of providing subsidised all-risk cover for crops is not the only way of organising crop insurance; and not necessarily the most efficient, either.

In the Russian literature there is an extensive discussion of crop insurance reform and the reform of agricultural insurance in general (VOROGAEV 1996; ZADKOV 1997; KIKHTEV and NAGORNOV 1997). ZADKOV (1997) has presented the most comprehensive reform proposal. He argues that the present voluntary state-subsidised all-risk crop insurance scheme should be retained, but that fundamental reforms are needed to overcome its present crisis and to make it more attractive to farms. A first step in this direction is the current reorganisation of crop insurance that started 1997 and whose most important measures have been an increase in premium subsidies, the founding of a new agency for the administration of crop insurance (the Agency for the Regulation of Insurance in the Sphere of Agroindustrial Production), and the creation of a Federal Agricultural Insurance Fund providing reinsurance to the firms that implement the state-subsidised crop insurance scheme on behalf of the state.

Experience in other countries has shown that all-risk or multiple-peril crop insurance¹ is a form of insurance that - apart from some short-lived unsuccessful attempts - has never been offered by an unsubsidised insurer. Where it does exist, it requires substantial subsidies to cover the administrative cost and often enough also part of the indemnities. Given limited budgetary resources, this raises the question whether state-subsidised all-risk crop insurance is needed in the first place. And if this question is answered in the negative, one has to address the issue how crop insurance should be designed instead. The objective of this paper is to discuss these two problems.

¹ The difference between these types of insurance is as follows: multiple-peril crop insurance provides insurance against losses and damages caused by, and only by, the perils explicitly named in the insurance contracts. All-risk insurance extends the coverage to perils that are not named explicitly in the contract. If a multiple-peril policy covers all important risks to crop production, the difference between these two forms of insurance is negligible.

The paper is organised as follows. Section 2 provides a brief overview of the development of Soviet and Russian all-risk crop insurance under the socialist system and in the first years of the transformation period, investigating the causes of the decline of crop insurance in Russia. Section 3 analyses the legal framework of the reorganisation of crop insurance started in 1997. Section 4 compares this conservative approach, which retains all-risk crop insurance and tries to remedy the deficiencies in its design, to the Czech approach to crop insurance reform, the transition from a compulsory state-subsidised multiple-peril crop insurance scheme to specific-risk crop insurance organised along strictly commercial lines. This strictly commercial approach could be - *mutatis mutandis* - an alternative way of reforming Russian crop insurance. Section 5 discusses the pros and cons of multiple-peril and all-risk crop insurance from an allocative point of view, concluding that there is no allocative justification for this type of crop insurance. This implies that crop insurance should be of the specific-risk type, i.e. it should offer cover for only a limited number of carefully selected risks. To obtain further results, section 6 develops a simple theoretical framework for analysing two issues: first, which perils should be included; second, whether and, if yes, how the government should intervene. Based on the results of section 5, section 7 discusses issues in the design of specific-risk crop insurance. Section 8 concludes the paper, summing up the policy implications for crop insurance reform in Russia.

2 THE DECLINE OF RUSSIAN CROP INSURANCE AND ITS CAUSES

Up to 1990 the Soviet Union had a state-subsidised compulsory all-risk crop insurance scheme for agricultural enterprises (*kolkhozes* and *sovkhozes*), which was run by the state insurance company *Gosstrakh*. This all-risk scheme insured all crops (except hay) against all possible natural hazards. If, due to a natural hazard, an agricultural enterprise's yield of a certain crop fell below the threshold of 70% of the average of the preceding five years, an indemnity was paid that covered 100% of the loss beyond the threshold. The indemnity payment was computed by multiplying the yield shortfall with state procurement prices. The premium was calculated by multiplying average gross revenue (average yield times state procurement price) with premium rates set by the state. The system of premium rate differentiation to account for varying risk in different agroclimatic regions was very crude. Premium rates were differentiated only according to relatively large territorial units (*oblasts*, *krais* and *republics*) (ZADKOV 1997, pp. 45, 47).

The state monopoly on insurance as well as compulsory crop insurance expired on 31st December 1990. But contrary to other branches of insurance that were left to the market, crop insurance has continued to be run by the Russian government, which has retained the authority to determine the perils to be covered, the premium rates, and the other relevant terms of insurance contracts. The policy chosen by the Russian governments since then has been to retain a state-subsidised all-risk crop insurance scheme. The only major change is that nowadays it is voluntary. Until mid-1997, when the Russian government embarked on a reorganisation of crop insurance, the state covered the administrative cost of the scheme, and paid a premium subsidy of 25%, though actual subsidisation was lower due to the fact that insurance premiums had to be paid out of post-tax profits. The sale of crop insurance contracts as well as their servicing (loss adjustment, monitoring of farming practices etc.) has been sourced out to private insurance companies hired by the federal government for that purpose (ZADKOV 1997, pp. 45-46, 48, 51; KIKHTEV and NAGORNOV 1997, p. 65; SCHWARZ 1999a).

Despite the 25% premium subsidy, crop insurance became insignificant in the first half of the 1990s. In 1995 only 1500 Russian farms had crop insurance (ZADKOV 1997, p. 46). This figure is tiny compared to the number of farms in Russia. At the end of 1994, there were 30500 large- and medium scale agricultural enterprises and 279200 family farms in Russia (GOSKOMSTAT ROSSII 1995, p. 48). As of today, crop insurance has remained insignificant. Only a small percentage of the eligible acreage is insured (SCHWARZ 1999b).²

The observed decline of crop insurance has several causes; some of them are responsible for the decline of agricultural insurance in general, others are specific to crop insurance. The first cause of the decline of agricultural insurance in general is inflation. In an environment of high inflation, which prevailed in Russia in particular up to 1993, insurance contracts that do not provide for an indexation of the sum insured and the indemnity payments are unattractive. But this was often the case in Russia. The introduction of new contracts that provided for the indexation of indemnity payments did not fundamentally change the situation, because the premiums to be paid for these contracts were very high (ZADKOV 1997, pp. 46-47). In the years 1996-1997 this factor somewhat lost in importance, since high inflation was temporarily brought under control by macroeconomic stabilisation. In these years the main causes of low demand for agricultural insurance were the bad financial situation and the high indebtedness of the majority of Russian agricultural enterprises, especially those producing for the market. The strong deterioration in agricultural terms of trade, widespread delayed payment for agricultural produce by traders and manufacturers, rationing on credit markets, inefficient allocation of resources within agricultural enterprises - these are the reasons why agricultural producers often had no money to purchase insurance (ZADKOV 1997, p. 46; VOROGAEV 1996, pp. 63-64, 67).

Agricultural enterprises have reduced demand for crop insurance more strongly than demand for other forms of agricultural insurance (ZADKOV 1997, p. 46). This has been due to a couple of factors, of which adverse selection is the most important one. Crop insurance has become unattractive for good risks. Since state authorities have so far failed to differentiate premiums within oblasts and krais, the system of regional differentiation of premium rates to account for varying risk has remained as crude as it was during Soviet times. But since crop insurance is voluntary now, the good risks that in Soviet times had subsidised the bad risks have taken the opportunity to leave the risk-sharing pool (ZADKOV 1997, p. 52).

Another important reason why crop insurance became unattractive for agricultural enterprises in the first half of the nineties was the lack of reinsurance facilities for the insurance companies that sold and serviced crop insurance contracts of the subsidised crop insurance scheme. As a result indemnity payments were often delayed when the crop in a certain region was bad and indemnity payments were due (ZADKOV 1997, p. 47). An additional factor have been those provisions in insurance contracts that allow the insurer not to pay indemnities in the case of a yield loss, if the agricultural enterprise has not followed the cropping practices specified in the contract. Under the prevailing conditions of crisis, producers have found it extremely difficult to meet these requirements and have thus often had problems being indemnified when a disaster struck (ZADKOV 1997, p. 52).

² Due to the relative insignificance of crop insurance, neither the Statistical Yearbook of Russia nor any other accessible publication contains data on crop insurance. We have therefore only given the figure of ZADKOV (1997). The paper by KIKHTEV and NAGORNOV (1997) published in December 1997 contains no indication that the situation has fundamentally changed since the publication of ZADKOV's paper.

3 THE REORGANISATION OF RUSSIAN CROP INSURANCE SINCE 1997

To overcome the dire state of Russian crop insurance, ZADKOV (1997) has proposed that the present state-subsidised all-risk crop insurance scheme should be retained, but that its deficiencies should be removed in order to increase participation. Among other things, he proposed stronger regional differentiation of premium rates, an arbitration procedure for loss adjustment, and state-subsidised reinsurance for the insurance companies selling and servicing crop insurance.

A first step towards implementing a reform of the type advocated by ZADKOV (1997) was taken in 1997 with the Federal Law of the Russian Federation No. 100-F3 "On the state regulation of agro-industrial production" of 14 July 1997 (FEDERAL'NYI ZAKON 1997), whose article 16 deals with the state regulation of insurance in the sphere of agro-industrial production. A second step was taken in 1998 with the Decision of the Government of the Russian Federation No. 1399 "On the state regulation of insurance in the sphere of agro-industrial production" of 27 November 1998, which is based on article 16 of the law of 14 July 1997 (POSTANOVLENIE 1998). According to the two normative acts agricultural insurance consists of two components:

- a crop insurance scheme, which is run, subsidised and regulated by the government of the Russian Federation,
- other types of agricultural insurance (livestock insurance etc.), whose supply is left to the market, the state confining its role to supervisory functions (FEDERAL'NYI ZAKON 1997, article 16, point 3; POSTANOVLENIE 1998, points 1 and 2).

In the following the main features of the new legal framework for Russian crop insurance will be described in detail: organisation, terms of insurance contracts, and reinsurance

Organisation

The Russian crop insurance system is organised in a four-tier hierarchy, each tier acting within the set of rules set by the superior tiers and setting the rules for the inferior tiers. **Tier 1**, the top tier, is the Duma, which has the supreme authority to determine the basic rules and the institutional structure of crop insurance. It has done so with the law of 14 July 1997, whose article 16 sets out the basic rules of crop insurance. **Tier 2** is the federal government, upon which the law of 14 July 1997 conferred the right to regulate agricultural insurance and to determine the rules of crop insurance in so far as they have not been fixed by the law (FEDERAL'NYI ZAKON 1997, article 16, point 3).

Tier 3 is the Federal Agency for the Regulation of Insurance in the Sphere of Agroindustrial Production (Federal'noe Agentstvo po Regulirovaniyu Strakhovaniya v Sfere Agropromyshlennogo Proizvodstva), which was founded at the beginning of 1999, following the government decision of 27 November 1998 (POSTANOVLENIE 1998, points 1 and 2). It will in the following be called the Agency. The Agency has three tasks. The first task is to develop proposals for the design of the state-run crop insurance scheme and the regulation of agricultural insurance, which are to be submitted by the federal ministries to the council of ministers. The second task is to supervise agricultural insurance. The third task is to manage the day-to-day operations of the crop insurance scheme. The management of crop insurance includes the following areas:

- The organisation of the invitation of bids from private insurance companies. The selected insurance companies are the **tier 4** of the Russian crop insurance system, selling and servicing crop insurance contracts to agricultural producers.

- The supervision of the insurance companies of tier 4 and the co-ordination of their activities.
- The provision of reinsurance to the implementing private crop insurance companies through the Federal Agricultural Insurance Reserve (Federal'nyi Sel'skhochozyaistvennyi Strakhovoi Rezerv) (POSTANOVLENIE 1998, point 2).

Terms of Insurance Contracts

As under the crop insurance system before the law of 14 July 1997, the catalogue of risks, for which insurance is offered, is determined by the government of the Russian Federation (FEDERAL'NYI ZAKON 1997, article 16, point 3). The government is therefore free to choose the type of insurance: all-risk, multiple-peril and specific-risk crop insurance (the latter restricts coverage to a limited number of carefully selected natural hazards) are feasible under the law. The government has so far retained all-risk crop insurance. There is no government decision to the contrary. The decision of November 1998 simply reiterates the rule that the government determines the catalogue of insured risks (POSTANOVLENIE 1998, point 7).

The other features of crop insurance contracts have, with one exception, also all been retained from the previous system. Crop insurance contracts have to be concluded for a minimum term of 5 years. The sum insured of an insured crop has remained 70% of its insurance value, which is computed every year anew as the product of the crop's predicted price and its average yield in the preceding five years. The insurance premiums are calculated as the product of the sum insured and the premium rate for the crop under consideration. The premium rates are determined by the government of the Russian Federation for a term of five years. Differentiation by regions and crops is possible (FEDERAL'NYI ZAKON 1997, article 16, point 1; POSTANOVLENIE 1998, point 7).

The major change concerns subsidisation. The premium subsidy paid out of the budget of the Russian Federation has been raised to 50%, though the actual rate of subsidisation is less, because insurance premiums are paid out of profits after taxes (FEDERAL'NYI ZAKON 1997, article 16, points 1 and 4; POSTANOVLENIE 1998, point 3). As before, the administrative cost of running crop insurance, which a commercial insurer would pass on to insured farms, does not enter into premium calculations and is explicitly or implicitly covered by the state. The government decision of November 1998 explicitly rules that premium rates are determined by the observed variability of yields, as well as climatic and natural conditions. The administrative cost is not mentioned as a determinant of premium rates (POSTANOVLENIE 1998, point 7). The Agency is financed by the federal budget and by a contribution from the Federal Agricultural Insurance Reserve. The latter must not exceed 0,5% of premium revenue (POSTANOVLENIE 1998, point 2).

Reinsurance and Reserves

A major institutional innovation of the 1997 law is the creation of a the Federal Agricultural Insurance Reserve, which is to safeguard the stability of agricultural insurance. Its volume is 5% of the premium revenue from crop insurance (FEDERAL'NYI ZAKON 1997, article 16, point 5). The major task of the Federal Agricultural Insurance Reserve is to provide reinsurance for crop insurance companies. Insurers implementing the state-subsidised crop insurance scheme are obliged to reinsure a fraction of their risk, i.e. a fraction of the sum insured of their crop insurance contracts, with the Federal Agricultural Insurance Reserve. The fraction of the risk to be insured is fixed by the government. The insurance companies are allowed to draw on the resources of the Federal Agricultural Insurance Fund, if their own assets do not suffice to finance indemnity payments and preventive measures associated with crop insurance

(POSTANOVLENIE 1998, point 5). An equally important role in primary insurers' risk management is assigned to the management of reserves. If a primary insurer's premium revenues exceed indemnity payments and the cost of preventive measures, then the surplus has to be added to the company's reserves, after deduction of the insurance company's outlays for the administration of crop insurance. The insurance company is allowed to draw on these reserves only if in a given year premium revenue does not suffice to meet indemnity payments due (POSTANOVLENIE 1998, point 5).

4 THE CZECH APPROACH TO CROP INSURANCE REFORM

It is not surprising that the Russian all-risk crop insurance scheme is highly subsidised. All-risk and multiple-peril crop insurance are types of insurance which - as experience in many countries of the world shows - require large premium subsidies to elicit significant voluntary demand from agricultural enterprises and farmers. This is clearly shown by the example of the *Federal Crop Insurance* in the United States and similar schemes in other countries (KNIGHT and COBLE, 1997, p. 130; WRIGHT and HEWITT 1994, pp. 76-84; ROBERTS and DICK 1991, pp. 8-16). One should therefore seriously consider the question whether Russia is best advised to retain a type of crop insurance that virtually no farm in any country of the world would purchase voluntarily at an unsubsidised premium. Would it not be more useful for Russia to abandon subsidisation and tight regulation of crop insurance, and to allow private-sector insurance companies to restructure their crop insurance business in such a way that it can cover its cost?

This is the Czech approach to crop insurance reform. Before the transformation process started, Czechoslovakia had a state-subsidised compulsory multiple-peril crop insurance scheme, which covered a broad spectrum of risks (though not all). The first steps of reform was the same as in the Soviet Union. Compulsory crop insurance was abolished. But here the similarities end. In contrast to Russia, privatisation of crop insurance in the Czech Republic was not only superficial. Government subsidies were abolished and private insurers given the freedom to restructure their crop insurance business in such a way that it became profitable. The result of this restructuring process is crop insurance that covers only a limited number of risks. The privatised ex-state insurer Česká Pojišťovna, which has remained the dominant supplier of crop insurance with a market share of over 90%, offers agricultural enterprises hail insurance, and natural-disaster insurance which covers a limited number of carefully defined perils. The bulk of Česká Pojišťovna's crop insurance business is hail insurance, which accounts for about 2/3 of the company's crop insurance premium revenue. This high share is not unusual, since hail insurance makes up roughly 70% of crop insurance business all over the world. Equally important is the fact that crop insurance in the Czech Republic, in contrast to Russia, has not become insignificant. About 1/3 of cultivated land is insured against hail. This share is low compared to Germany where it reached 70%. However, in comparison to Russia it is high (WILDERMUTH 1998; VILHELM 1996, pp. 75-77).

Can the Czech approach be a blueprint for crop insurance reform in Russia? The first point to notice in this respect is that a simple comparison of the Russian and Czech experiences does not provide an answer to this question, since the decline of Russian crop insurance is to a large extent due to the general crisis of Russian agriculture and serious deficiencies in the design of Russian all-risk crop insurance, e.g. the lack of reinsurance facilities and the crude regional differentiation of premium rates. For this reason a different approach has to be chosen. We must first discuss whether convincing arguments can be found in support of state-

subsidised all-risk or multiple-peril crop insurance. Only if we can show that this is not the case, can we turn to alternatives and discuss the merits and limitations of the Czech approach.

5 THE PROS AND CONS OF MULTIPLE-PERIL AND ALL-RISK CROP INSURANCE

In the literature there is an intensive debate on the pros and cons of multiple-peril and all-risk crop insurance. To simplify the analysis, we do not make a distinction between these two types of insurance in this paper because they are very similar, if the list of perils covered by multiple-peril crop insurance includes almost all major perils. The discussion in the literature revolves around a positive and a normative issue. The positive issue is why unsubsidised multiple-peril/all-risk crop insurance has failed to emerge in the market. The normative issue is whether the government should offer this risk-management tool, if the market fails to do so, and whether its subsidisation can be justified.

We will turn first to the positive issue. There are basically two lines of argument on the issue of the causes of the non-existence of unsubsidised multiple-peril or all-risk crop insurance. The **first line of argument** implicitly or explicitly takes it for granted that multiple-peril/all-risk crop insurance generates gains from trade, and explains the commercial non-viability of this type of insurance with problems of asymmetric information (moral hazard, adverse selection) and the difficulties of pooling covariate yield risk, i.e. yield risk that exhibits a strong positive correlation across farms. If the market fails to solve these problems, state intervention in the provision of multiple-peril/all-risk crop insurance could be justified, though it should not necessarily take the form of subsidisation. According to the **second line of argument**, the high level of subsidies required by multiple-peril/all-risk crop insurance schemes is a clear indication that there are no gains from trade in the first place so that state intervention in the provision of this type of insurance (let alone its subsidisation) is not only unnecessary, but welfare-decreasing.

Let us review both lines of argument in turn, starting with the **first line of argument**. QUIGGIN (1994, pp. 116-117) and MIRANDA and GLAUBER (1997, pp. 205-207) argue that one of the reasons why multiple-peril and all-risk crop insurance do not emerge spontaneously in the market is the problem of covariate yield risk. Does this argument stand up to critical scrutiny? An important point to note is that high positive correlation of yield risks across agricultural enterprises in a given geographical region presents no insurmountable obstacle to insurability if the income risk from crop shortfalls is idiosyncratic diversifiable risk on a world-wide scale. The reason is that - provided the necessary risk markets exist - the risk can be spread to so many risk-bearers that it is possible to invoke the Arrow-Lind theorem (ARROW and LIND 1970). Applied to insurance, this theorem states that the collective risk loading of an insurance syndicate consisting of risk-averse individuals converges towards zero, if the syndicate members' incomes are not correlated with the insured risk, and if the number of syndicate members goes towards infinity. In this case, despite the risk aversion of its members, the insurance syndicate behaves as if it were a risk-neutral insurer (GRAVELLE and REES 1992, pp. 594-598). This perfect risk spreading is, of course, a benchmark case which cannot always be attained in reality. But, on the other hand, behaviour of insurers often comes very close to this benchmark case.³

³ A good example is the German standard hail insurance contract. This contract contains no deductible, but provides full insurance up to 125% of the sum insured, the physical loss being measured as the deviation of the actual yield after the hailstorm from the yield that could have been expected if the hailstorm had not occurred. The only limit on indemnification for losses below the value of the sum insured is the provision that losses have

The means commonly applied by insurance companies for spreading their risks is to enter into reinsurance contracts with international reinsurers, in conjunction with the management of reserves. Some of the proponents of the first line of argument take the view that private reinsurers cannot be expected to provide the necessary reinsurance. QUIGGIN (1994, p. 117) e.g. argues that only the state can be expected to have a sufficiently large and diversified portfolio of assets to provide reinsurance cover for large-scale multiple-peril crop insurance. MIRANDA and GLAUBER (1997, pp. 209-210) quote KRAMER (1982) to assert that the historical record shows that a private crop insurance industry cannot develop anywhere in the world solely around the risk management services provided by major reinsurers. They argue that reinsurers, despite their larger size and better portfolio diversification, ultimately face the same limitations as a primary insurer because they, too, are designed to deal with idiosyncratic diversifiable risk only. According to MIRANDA and GLAUBER (1997) this makes them incapable of coping with the huge losses associated with, say, a widespread drought.

Two points merit attention. First, even if QUIGGIN (1994) and MIRANDA and GLAUBER (1997) are right, their arguments can justify only the provision of reinsurance by the state, but not large-scale subsidisation of multiple-peril or all-risk crop insurance. Second, the assertion that insurance companies insuring covariate crop yield risk cannot obtain reinsurance cover for their portfolios does not necessarily hold for insurers that restrict their coverage to few perils, even if the losses caused by these perils are characterised by strong positive correlation across farmers. There are examples of unsubsidised public-sector crop insurance schemes insuring sugar farmers against the risks of cyclones (in Mauritius) and banana farmers against the risk of hurricanes (in the Windward Islands). These companies manage to do so without state support because they reinsure most of their risk. Another example is the Chilean voluntary private-sector crop insurance scheme, which covers risks like drought and flood in cereal production. Right from the start of the scheme the Chilean insurer reinsured most of its risk (ROBERTS and DICK 1991, pp. 45-60, 93-108, 135-144). The reason why this is possible is simple and has been overlooked by MIRANDA and GLAUBER (1997). Although the reinsured risks are to a large extent systemic to the agricultural sectors of Mauritius, the Windward Islands and Chile, they are idiosyncratic on a world-wide scale and therefore reinsurable. The same holds for other crop yield risks, provided they are idiosyncratic on a world-wide scale. The apparent impossibility of unsubsidised multiple-peril and all-risk crop insurance must, therefore, have other reasons.

The next issues we will discuss are the problems of asymmetric information. Consider adverse selection first. As BINSWANGER (1986, pp. 77-78) has pointed out, the insurer faces a fundamental trade-off between information costs and incentives. Given initial asymmetric information between the insurer and the farmer, an insurer wanting to avoid adverse selection right from the beginning of the scheme would have to carry out actuarial calculations to

to be borne by the farmer himself, if they are below 8% of the no-hailstorm yield (HILDEBRANDT 1988, pp. 280-281; N.N. 1994; N.N. without year). This type of insurance contract comes very close to the ideal Pareto-optimal insurance contract between a risk-neutral insurer and a risk-averse insured that has been derived by RAVIV (1979) for the case of symmetric information and costs that are independent of the size of the indemnity. In this case all risk is borne by the insurer, the insured gets full insurance. The slight deviations from full insurance can easily be explained with other results of optimal insurance theory, again, always assuming a risk-neutral insurer. As GOLLIER (1987) has shown, non-indemnification of small losses is part of a symmetric information first-best insurance policy if loss adjustment entails positive costs that are independent of the size of the loss. A result in WINTER (1992, pp. 75-78, 90-91) shows that the upper limit on indemnities (here 125% of the sum insured) can be part of an insurance policy if there is moral hazard on loss-reduction.

determine for each agricultural enterprise probability distributions of yields contingent on the production technology used. Since yield risks can vary widely even in a small geographic area, these actuarial calculations would have to be performed for a large number of small regions. The cost of obtaining the information necessary for ruling out adverse selection is therefore extremely high. It is, of course, possible to economise on information cost if one uses for premium calculation information on the averages and distributions of yields in relatively large regions. But this would lead to the classical adverse selection problem and market failure as described by BORCH (1990, p. 317): Good risks, whose expected loss falls far short of the average premium, will leave the pool. As a result, claims will on average exceed premium revenue so that the insurer would have to raise premium rates to achieve an expected profit of zero; provided, of course, that the set of insured farmers remains unchanged. Unfortunately, this will not be the case because the increased premium rate will make some lower-risk farmer leave the risk-sharing pool so that the original problem repeats itself. In the end the risk may turn out to be uninsurable. Subsidies to insurers or compulsory insurance would be required for preventing the collapse of the market. But this argument rests on the tacit assumption that the insurer does not use the information on the insured agricultural enterprises' loss experience. In other words, it is assumed that the insurer does not use the techniques of experience rating, which allow the adjustment of premiums and indemnity schedules to the insured's loss experience. By this means, with the passage of time, the terms of the insurance contract can be adjusted to the individual agricultural enterprise's risk characteristics as the insurer obtains more and more information about them. Experience rating is a common device in hail insurance as well as in other forms of crop insurance to solve problems of adverse selection (and also to combat moral hazard problems) (HILDEBRANDT 1988, p. 281; ROBERTS and DICK 1991, pp. 96-98.). As pointed out by GARDNER (1994, pp. 37-38), experience rating could be used in all-risk and multiple-peril crop insurance to overcome adverse selection problems with the passage of time. The fact that many multiple-peril crop insurance schemes (including the US American one) have failed to employ experience rating could therefore be the reason why subsidisation is necessary. But GARDNER is sceptical in this respect. In assessing the US multiple-peril crop insurance program, he argues that the failure of this scheme to draw high participation at reasonably low government cost weighs heavily against the prospects of a substantial reduction of government subsidies with a reform that introduces experience rating into the present multiple-peril crop insurance scheme and readjusts premiums in order to remove persistent differences in loss ratios across states.

Something else must therefore be responsible for making unsubsidised multiple-peril and all-risk crop insurance so unattractive to farmers and agricultural enterprises. This „something else“ is the availability of on-farm risk-management tools for self-insurance and self-protection. Following EHRLICH and BECKER (1972), self-protection is defined as a reduction of the probability of the loss event, and self-insurance as a reduction of the losses in the case of a loss event. An example of self-protection would be the use of pesticides to prevent the outbreak of diseases. Self-insurance could be achieved e.g. through diversification in order to reduce the impact of natural hazards.

The availability of on-farm risk-management tools can create moral hazard problems if the insurance company cannot monitor their use, or if the cost of monitoring is such that the insurer's benefits from enforcing symmetric-information first-best self-protection and self-insurance fall short of the cost. Since, in this case, an insured agricultural enterprise will not capture the full benefits of efforts to reduce risk, insurance reduces the incentives to avoid or

to mitigate losses (WINTER 1992, pp. 61-62). If this is the case, the optimal insurance contract invariably deviates from a symmetric-information first-best contract, thus causing a welfare loss. If e.g. the symmetric-information first-best contract between a risk-neutral insurer and a risk-averse insured involves full insurance, a second-best solution will entail some kind of risk-sharing leading to a welfare loss. Under certain circumstances this risk-sharing can take the form of a deductible or an upper limit on indemnities, but for the general case it is difficult to derive properties of the indemnity schedule that hold in all possible cases (WINTER 1992, pp. 71-78, 88-91; SCHÖNFELDER 1986, pp. 230-235; GROSSMAN and HART 1983). This deviation from the symmetric-information first-best solution entails a social welfare loss which can be so high that in the presence of transaction costs the gains from trade from insurance vanish and the risk becomes uninsurable. According to SCHÖNFELDER (1986, pp. 234-235) this market failure can justify the subsidisation of monitoring activities because their social benefits in terms of welfare gains can exceed their private benefit to the insurer whose additional profit might be bid away by a competitor. This argument holds, but it should be noted that it is only an argument for a particular kind of transaction cost subsidy, not for large-scale subsidisation of operating costs and premiums as in the United States, where the states bears all operating costs and grants subsidies of up to 30% of net risk premiums (GARDNER 1994, p. 30; KNIGHT and COBLE, 1997, p. 130).

But the availability of on-farm risk management tools can have another effect. If they are efficient enough they can make crop insurance superfluous, in the sense that even for a risk-neutral insurer it is impossible to find a collective of farmers to whom he can offer insurance contracts that will make them better off and at least cover his opportunity cost. This is the central point of the **second line of argument** and has been elaborated in detail by WRIGHT and HEWITT (1994). These authors argue that theoretical models, which explicitly or implicitly assume that multiple-peril crop insurance, all-risk crop insurance or revenue insurance⁴ are the only available risk-management tools, greatly overstate the benefits of these types of insurance. These models neglect the elementary fact that insurance is only one risk-management tool among many; i.e. the benefits and costs of insurance have to be weighed against the costs and benefits of on-farm risk-management tools (spatial diversification, crop diversification, loss-reduction technologies like irrigation, off-farm employment in the case of a family farm, and intertemporal financial smoothing. The latter means that an agricultural enterprise or a farmer varies savings and uses the credit market to reduce the impact of income fluctuations (WRIGHT and HEWITT 1994, pp. 90-95). Therefore, the authors propose the following thesis (1994, p. 95):

„If insurance offered on competitive terms (recognising the true opportunity cost of resources) by private and public insurers is accepted by farmers, then such insurance may be socially valuable, unless it exacerbates other sources of market failure such as environmental externalities. Its value is not, however, the full value (net of costs) of the smoothing of consumption achieved by insurance, but the value relative to what could be achieved in the absence of insurance. When farmers don't buy insurance on competitive terms, the simplest inference is that this value is negative.“

Therefore, according to these authors, the reason for the non-existence of unsubsidised multiple-peril crop insurance is simply that „multiple-peril crop insurance is worth less than it costs, if full costs are covered by premiums in the long run“ (WRIGHT and HEWITT 1994, p. 88). They provide evidence from studies on the US multiple-peril crop insurance programme to support their thesis. For details the reader is referred to their paper; in our paper

⁴ Revenue insurance simultaneously insures yield and output price risk.

we want to report only the results of a study carried out by the Economic Research Service of the United States Department of Agriculture at the end of the 80s (U.S. CONGRESS 1989).

In this study farmers who did not sign up for federal crop insurance were sent a questionnaire containing a list of possible reasons for non-participation. They were asked to rank these reasons: No. 1 for the most important reason, no. 2 for the second most important reason and so on. The study was motivated by the fact that non-participating farmers at that time represented the majority. In the years preceding the study, only between 20 and 25% of eligible acreage were insured (GARDNER, 1994, p. 31).⁵

The number one reasons for non-participation provided by the respondents are given in Table 1.

Table 1: The distribution of the number one reasons for non-participation in U.S. multiple-peril crop insurance

| | |
|---------------------------|-------|
| Coverage too low | 24.8% |
| Premiums too high | 23.3% |
| Prefer to take risk | 23.0% |
| Farm is diversified | 9.9% |
| Have other crop insurance | 5.5% |
| Government will bail out | 3.7% |
| Knowledge about risk | 3.4% |
| Too much paperwork | 3.3% |
| Not contacted | 3.0% |

Source: U.S. CONGRESS (1989), quoted in WRIGHT and HEWITT (1994, p. 102).

WRIGHT and HEWITT point out that the top five reasons, covering almost ninety percent of respondents, are versions of one general response ‘The benefit wasn’t worth the cost’. Only 3.7% listed the anticipation of disaster relief as the main reason for non-participation, whereas 59% of the respondents ranked the anticipation of disaster relief as unimportant (WRIGHT and HEWITT 1994, p. 103; U.S. CONGRESS 1989). They therefore conclude that it is not disaster assistance that is the main reason for the non-participation of most farmers, but the fact that benefits are smaller than costs. And this, although insurance premiums are heavily subsidised.

One can therefore conclude that the verdict of the market on all-risk and multiple-peril crop insurance can be accepted. There is convincing evidence that the second line of argument is correct, and that this type of insurance does not emerge in the market, because its net benefit to society is negative. This implies that one also has to accept the normative implication of the second line of argument: there is no allocative justification for state-subsidised multiple-peril and all-risk crop insurance schemes. This type of crop insurance should therefore not be retained in Russia. But what sort of insurance is needed? This is the issue of the next sections.

⁵ Participation increased in later years (in 1994 38% of eligible acreage was insured), but is still a long way from the target participation rate of 50% (KNIGHT and COBLE, 1997, p. 130).

6 A CONCEPTUAL FRAMEWORK FOR THE DESIGN OF SPECIFIC-RISK CROP INSURANCE

The rejection of all-risk and multiple-peril crop insurance already implies a vindication of an important aspect of the Czech approach to crop insurance reform. Crop insurance should be of the specific-risk type, i.e. restrict coverage to a limited number of carefully selected natural hazards. This raises two questions:

- What perils should be covered?
- What is the role of the government? Should it leave crop insurance to the market or should it intervene? In the case of the latter, what form should intervention take?

To answer these questions, one needs a conceptual framework for analysis. In the following we will propose such a framework. It is developed in the following way:

Step 1: Analysis of risk-management at the farm level

Step 2: Based on the results of step 1, derivation of a condition for the insurability of a particular natural hazard

Step 3: Discussion of welfare implications

Step 1: Analysis of risk-management at the level of the individual farm

When a farm makes its production decision under uncertainty, it has to choose a risk-management strategy from the set of available risk-management strategies. This set contains risk-management strategies with and without crop insurance. For the purpose of our argument, we will assume that there is no subsidisation of crop insurance or any other risk-management tool. When choosing among the available risk-management strategies the farm has to perform an implicit or explicit assessment of the available risk-management strategies and choose the most favourable one. So the question arises: how should alternative risk-management strategies be evaluated? Or for the purpose of the economic policy adviser: how should a farm's choice among risk-management strategies be modelled? To answer this question, we will use a simple model, which can be analysed in verbal terms.

Assume that the farm's decision-making behaviour is that of a risk-averse expected utility maximiser. Consider the income risk stemming from a natural hazard like drought (as experienced in 1998 in many Russian regions), which will henceforth be called yield risk. We shall assume that uninsurable income risk is stochastically independent of the yield risk so that the farm's insurance decision can be separated from other risk-management decisions (SCHLESINGER and DOHERTY, 1986). This is a reasonable assumption for natural hazards in an environment with a high degree of market integration.⁶ We shall also assume that the farm has the choice between two and only two risk-management strategies to deal with yield risk:

- Crop insurance, which is assumed to be provided at a premium equalling the sum of the expected value of damages, the administrative cost loading and (if the insurer is risk averse) the insurer's risk loading,
- An alternative self-insurance technology without crop insurance whose adoption is assumed to lead to a deterioration of expected income.

⁶ If the assumption of stochastic independence is dropped, it is no longer possible to consider the insurance decision in isolation. Instead, the demand for insurance is determined simultaneously with other risk-management decisions (MAYERS and SMITH 1983).

To simplify the exposition, we shall assume that either of these risk-management strategies is more advantageous to the farm than no risk-management at all. We also assume that the two risk-management strategies cannot be mixed. The farm chooses either crop insurance or the self-insurance technology.

One way of formulating the farm's problem is as follows:

Choose the risk-management strategy that maximises the certainty equivalent of the income distribution associated with the respective risk-management strategy.

Under the assumptions made, the certainty equivalents of the two risk-management strategies to be compared are equal to the farm's initial expected income without risk-management minus the sum of two terms: the reduction of expected income and the risk premium associated with the risk-management strategy.

Since the farm's initial expected income is independent of the chosen risk-management strategy, an equivalent way of formulating the farm's problem is as follows:

Choose the risk-management strategy that minimises the sum of the expected income reduction and the risk premium.

This alternative formulation has an interesting economic interpretation. The sum to be minimised can be interpreted as the cost of risk management. What this term means precisely, will be clarified in the next paragraphs.

Consider the Arrow-Debreu world with symmetric information, zero transaction costs and complete markets (ARROW, 1964). In this ideal world there are no institutional obstacles to risk-spreading. Provided an agricultural enterprise's income risk, whatever its source may be, is idiosyncratic risk on a world-wide scale, it is possible by virtue of the Arrow-Lind theorem to organise an insurance syndicate that is ready to offer full insurance at a fair premium, i.e. at a premium which equals the expected value of the loss. Insurance of this type would allow the farm to shed all risk without having to accept a reduction in expected income. The certainty equivalent of this ideal risk-management strategy would be the initial expected income, so that the cost of risk-management would be zero. The Arrow-Debreu world is the ideal of neoclassical economics, which has only one drawback: it does not exist and cannot exist in the real world, where problems of asymmetric information and transaction costs are all-pervasive. But the concept of the Arrow-Debreu world is nonetheless useful, because full insurance at a fair premium provides a benchmark against which the performance of the necessarily imperfect risk-management tools of the real world can be measured. The cost of a real-world risk-management strategy, as we have defined it above, is a monetary expression of the welfare loss that the farm incurs when it has to substitute an imperfect real-world risk-management strategy for the unattainable perfect risk-management strategy „full insurance at a fair premium“. The farm's cost minimisation problem is therefore an attempt to get as close as possible to this ideal risk-management strategy.

Now let us take a closer look at the cost of the two-risk management strategies. We begin with crop insurance. The costs of crop insurance are administrative costs, agency costs and (in case the insurer is risk-averse) risk-loading costs. We consider administrative costs first. They encompass the following items:

- overhead cost of organising crop insurance (accounting, personnel department etc.).
- cost of acquiring information on the probabilities of the loss event and the loss distribution contingent on the occurrence of the loss event. The information thus acquired is necessary in order to reduce adverse selection problems.
- cost of monitoring farms' risk-reduction measures to combat moral hazard.
- expected cost of loss adjustment.

In the absence of subsidisation these costs would have to be charged to insured farmers in the form of an administrative cost loading. This loading would be added to the net risk premium, i.e. the expected value of the indemnity. Each insured farm would have to pay a share of the fixed cost of organising crop insurance.

Now let us turn to the agency cost. In the case of remaining moral hazard and adverse selection problems the insurer has to write incentive-compatible contracts that involve second-best risk-sharing arrangements for all or some insured farms, and thus involuntary risk-bearing. This involuntary risk-bearing causes a welfare loss that is called agency cost. This cost can be measured by the increase in risk premiums that has been caused by the involuntary risk-bearing.

Last but not least, let us take a look at the risk-loading cost. If risk markets are imperfect, the insurer or its equity-holders may be unable to completely diversify their risk. In this case the insurer has to be paid a risk loading to accept the risk. But note that in economies with well-developed risk markets the risk loading is likely to be relatively low.

The second risk-management strategy is the self-insurance technology, which has the following costs:

- Reduction in expected income.
- If the self-insurance technology reduces only part of the income risk, the remaining income risk causes an additional welfare loss, which can again be measured by the agricultural enterprises' risk premiums.

If the farm seeks to minimise the cost of risk-management, it will choose crop insurance if the sum of its agency cost and its share in the cost of organising crop insurance is smaller than the cost of the self-insurance. Otherwise it will choose self-insurance.

Step 2: Derivation of a condition for the insurability of a particular natural hazard

Having obtained this result, the derivation of a necessary and sufficient condition for the insurability of a natural hazard is straightforward.

The peril under consideration is insurable, if and only if it is possible to find a collective of farms for which the cost of crop insurance is lower than the cost of the self-insurance technology.

The rationale of this condition is straightforward. We only want to mention that the condition has to be stated for collectives, because the existence of fixed costs of crop insurance creates economies of scale.

Step 3: Discussion of welfare implications

If a risk is insurable in the sense of our condition for insurability, does this mean that the introduction of insurance invariably increases social welfare? The answer to this question is

no. In a world of incomplete and imperfect markets prices, as a rule, deviate from social opportunity costs (LAFFONT 1991, pp. 91-93). Therefore insurability does not necessarily mean increase in social welfare; nor is non-insurability necessarily equivalent to a decrease in social welfare.

The consequence for the policymaker is simple in principle, but difficult to implement in practice. One needs to assess whether the distortions of the price system due to missing markets are so severe that there is a high probability that insurability (non-insurability) does not imply an increase (decrease) in social welfare. If price distortions are small, then there is a high probability that one can successfully apply the rule of thumb that insurability implies an increase and non-insurability a decrease in social welfare. But if price distortions are strong, then non-insurability does not necessarily imply that an insurance scheme does not lead to an increase in social welfare.

7 ISSUES IN THE DESIGN OF CROP INSURANCE

From our condition of insurability it is clear that insurance for a natural hazard may not be worth the while, if there are low-cost self-insurance technologies, and if the cost associated with organising insurance against this peril is relatively high. This is basically the reason why insurance for many kinds of perils is not available on the market and why occasional attempts by private insurers to offer commercial multiple-peril crop insurance have failed. Hail insurance, on the other hand, is the standard product of crop insurance because self-insurance technologies are either unavailable or extremely expensive, and because the administrative and agency costs of providing it are low (QUIGGIN 1994, p. 121). The lack of adequate self-insurance technologies reduces moral hazard problems to a minimum, and information on hailstorm probabilities and the impact of hail on crops can be obtained relatively cheaply so that an insurer using this information and experience-rating can keep adverse selection problems also to a minimum. Another important point is that hail damage is relatively easily identifiable as such and easily measurable so that loss adjustment is not too expensive (BINSWANGER 1986, pp. 77-78; HILDEBRANDT 1988, p. 281; ROBERTS and DICK 1991, p. 31).

For the risks like hail the question whether insurance generates gains from trade or not can be answered relatively easily. But there are risks on the threshold of insurability, for which the available self-insurance technologies, although cheaper and more effective than those for hail, are so costly that crop insurance can be a substitute, if its cost can be kept low enough. Whether risks of this type should be covered in a crop insurance scheme, therefore depends on a feasibility study carried out for the risk in question. There are no easy answers. An important point to be borne in mind is that under these circumstances state intervention can (but need not) be welfare-enhancing.

State intervention frequently takes the form of crop insurance offered by parastatal bodies, often connected with compulsory insurance. Compulsory insurance is often advocated for crop insurance on the grounds that it can overcome problems of adverse selection (e.g. BESLEY 1995, p. 2160). What is often overlooked is that compulsory insurance also makes it possible to economise on transaction costs in the form of marketing and contracting costs. Furthermore, it can make it easier and cheaper to enforce strict monitoring of agricultural practices in order to minimise moral hazard on loss-prevention.⁷ The crucial point for our

⁷ An example of a compulsory unsubsidised crop insurance scheme with strict monitoring is the Mauritius Sugar Insurance Fund. For details see ROBERTS and DICK (1991, pp. 93-108).

discussion is that the cost savings made possible by an efficiently run compulsory insurance scheme can make the difference between welfare-enhancing insurability of a risk and its non-insurability; always assuming that there are no permanent subsidies.

This brings us to the issue of subsidisation. The successful example of the Mauritius Sugar Insurance Fund has demonstrated that some initial subsidy in the start-up phase of a crop insurance scheme can be justified. But what about permanent subsidies? The danger of permanent subsidies is that they can distort the choice of risk-management tools, in the sense that more efficient self-insurance is discarded in favour of subsidised crop insurance, thus causing a social loss (WRIGHT and HEWITT 1994, pp. 97-98).

This is an important argument against subsidisation; but one has to keep in mind that in the real world with its incomplete and imperfect markets, market prices, as a rule, deviate from social opportunity cost. If these discrepancies are small, WRIGHT and HEWITT'S (1994) argument holds.

But if they are large, subsidisation can be welfare-improving. If e.g. improvements in the road and telecommunication infrastructure cannot be financed due to a lack of access to credit markets, this lack of an adequate infrastructure can drive up transaction costs to such an extent that otherwise feasible insurance becomes infeasible. In this case subsidisation of the operating costs of a crop insurance scheme can be welfare-enhancing.

8 CONCLUSIONS FOR RUSSIA

The discussion implies that there are no convincing economic reasons for retaining the Soviet all-risk crop insurance system in the way suggested by ZADKOV (1997). The already moribund scheme should be abolished and, as in the Czech Republic, be replaced with a system of crop insurance that restricts its coverage to those perils for which cost-covering crop insurance is part of the optimal risk-management strategies for a considerable number of farms. This is the case for perils for which it is possible to find a mix of investment in information collection and incentive-compatible contract design such that for the collective of insured farms the sum of administrative and agency costs becomes lower than the cost of an alternative self-insurance technology. Which perils meet this requirement in the particular case of Russia, has to be found out in empirical research. It will, of course, be necessary to consider the different climate zones of Russia separately.

A possible candidate for an insurable risk is the *sukhovei*. The *sukhovei* is a dry and hot steppe wind, which occurs in the steppe zone of Southern Russia. The consequences of a *sukhovei* for plants are disastrous. If it occurs, standing grain can wither within few hours, since the *sukhovei* causes a grave moisture deficit on the surface of the leaves. As a rule, a *sukhovei* occurs too late to make a second planting possible. It can therefore cause tremendous yield losses (STADELBAUER 1996, pp. 357, 359). The *sukhovei* has some properties in common with hail. As in the case of hail, *sukhovei* damage is easily identifiable as such and measurable so that loss adjustment is relatively easy. Like with hail, the farmer cannot influence the probability of the loss event, and the only way of avoiding *sukhovei* damage with certainty is to relinquish crop production altogether (REINSBERG 1999). There are therefore no grave moral hazard problems. The only major difference between hail and the *sukhovei* (from the point of view of insurability) is that the *sukhovei* hits many farms at a time, i.e. the risk of *sukhovei*-induced crop losses is characterised by strong positive correlation across farms in a region. But as has already been said above, this is no insurmountable obstacle to insurability.

Turning to state intervention in crop insurance markets, it is impossible to make statements of the sort that some type of state intervention should be ruled out in all conceivable cases. State intervention in the form of compulsory insurance can reduce costs and thus make a risk insurable. Subsidisation can under some conditions increase welfare in a world with incomplete and imperfect markets. Careful analyses are required for each peril and region before the government intervenes in crop insurance markets. But there is one important caveat: if one opts for state intervention in the form of subsidisation, it must be avoided that these subsidies become one of the many avenues for channeling income transfers to farmers.

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