

The reform of the common agricultural policy: Effects on farm labour demand in Austria

Die Reform der Gemeinsamen Agrarpolitik: Auswirkungen auf die
Beschäftigung in der österreichischen Landwirtschaft

Erwin SCHMID, Franz SINABELL¹

Zusammenfassung

Am 26. Juni 2003 wurde die Reform der Gemeinsamen Agrarpolitik (GAP) beschlossen. Die Kernelemente der Reform sind die Entkopplung der Direktzahlungen und die Reduktion der Interventionspreise für eine Reihe von agrarischen Produkten. Die Ziele der Reform sind die Verringerung der Überschüsse von Getreide, Rindfleisch, Zucker, und Milch, die Stabilisierung der Einkommen und die Verbesserung der Wettbewerbsfähigkeit des europäischen Agrarsektors. Modell-ergebnisse zeigen, dass diese Ziele in Österreich im Wesentlichen umgesetzt werden können. Den Mitgliedsstaaten stehen verschiedene Entkoppelungsstrategien zur Verfügung, die ab 2005 implementiert werden. Ein wichtiges Ziel in Österreich ist die Sicherstellung der flächendeckenden Landwirtschaft. Mit einem Agrar-Sektormodell werden Veränderungen des landwirtschaftlichen Arbeitskräftebedarfs geschätzt, welche aufgrund der verschiedenen Entkoppelungsstrategien zu erwarten sind.

Schlagworte: PASMA, Sektormodell, Halbzeitbewertung der GAP, Arbeitskräfte in der Landwirtschaft

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Summary

On 26th June 2003, an agreement was reached by agricultural ministers to reform the Common Agricultural Policy. Decoupling direct payments from farm output and reductions of administrative prices are core elements of this reform. Major reform goals are less output of cereals, beef, sugar and milk, stabilised farm incomes and a more competitive farm sector. Model simulations show that these results will likely materialise in Austria. Member states have various options to choose in which way direct payments will be decoupled from 2005 on. An important Austrian policy goal is to ensure the maintenance of farming in all regions. A sector model is used to estimate farm labour demand in response to the policy change. The analysis shows how sensitive farm labour demand is to the various decoupling strategies.

Keywords: agricultural sector modelling, mid-term review of the common agricultural policy, farm labour

1. Introduction

The Berlin Council agreed on a reform of the Common Agricultural Policy (CAP) in 1999. The European Commission was directed to conduct a mid-term review (MTR) in order to analyse the advances of the reform process and to submit proposals in the event that further adjustments were seen to be necessary.

In mid 2002, the European Commission published its report on the review. Half a year later a proposal for a Council Regulation was submitted. It showed that – according to the European Commission – mere adjustments would not be sufficient to cope with the challenges of the future. Consequently, a further substantial reform was proposed that promised "a long-term perspective for a sustainable agriculture" (Fischler, 2003A).

The objectives of the CAP reform 2003 are to:

- stimulate the competitiveness of EU's agricultural sector by steering production decisions as response to market signals and not to government intervention and subsidies,
- allocate more funds for rural development programmes,
- reduce export subsidies and enhance transfer efficiency by utilising a new way of farm support,
- finance further reforms within existing budget limits,

- stabilise agricultural incomes, and
- guide agricultural production towards consumer interests, assure quality farm products, make production processes more environmentally friendly, and respond to animal welfare concerns (European Commission, 2003).

In order to achieve these goals, the following measures were agreed upon:

- to modify market regimes (reduction of administrative prices, special regulations for protein crops and durum wheat, prolongation of the milk quota system),
- decouple direct payments, and
- several accompanying measures (e.g., degression, modulation, new instruments to enhance consumer trust, additional environmental and animal welfare standards).

After the MTR agreement, member states have even got more freedom to fine tune CAP-instruments according to their specific policy goals. Such an opportunity comes at some costs. There is for instance a trade-off between aggregate farm income and farm employment. The extent depends on whether direct payments will be fully decoupled or not.

This paper is organised such that after a description of the reform elements and a presentation of the analysis tool, trade-offs will be quantified for the Austrian agricultural sector. This analysis builds on a unique data set of very specific standard farm labour estimates that account for structural and natural disadvantages of less favoured areas.

2. Selected details of MTR

In 1992, a fundamental change was introduced in the CAP. Direct production incentives of higher agricultural commodity prices were cut. To compensate farmers for price drops, direct payments were introduced. Additional premiums are granted when specific animals are slaughtered (bulls, oxen, calves, cows, heifers) or raised on the farm (suckler cows and heifers, sheep and goats), and an extensification premium is paid when the number of animal units per hectare of land is below a certain limit.

In MTR, farm ministers (Greek Presidency, 2003; Fischler, 2003B) agreed to decouple direct payments from production and to grant

these payments as a single transfer to farmers. It will be even paid if a farmer chooses not to produce, as long as "land is maintained in good agricultural and environmental condition".

Farmers are entitled to premiums based on historic payments and acreages (average of 2000 to 2002). The total of premiums per farm is divided by the sum of reference crop and forage acreages, thus obtaining the average farm premium per hectare. Entitlements are transferable between farmers within a region or state and adjustments will be made during the reform period. Member states may choose to introduce the single farm payment in full or they may opt to:

- retain up to 25 % of the payments for arable crops or up to 40 % of the special assistance for durum wheat,
- continue to couple up to 50 % of the premiums for sheep and goats,
- keep the slaughter premium, or 75 % of the special bull and steer premium, or the suckler cow premium and up to 40 % of the slaughter premium,
- retain up to 10 % of direct payments for measures that have positive environmental effects or/and improve the quality and marketing of farm products.

If farmers receive direct payments, they must set aside part of their land (small and organic farms are exempted) and must comply with environmental standards i.e., cross-compliance.

Direct payments for larger farms will be reduced up to 5 % i.e., modulation. The funds saved by modulation will be used to reinforce the programme of rural development. Via this new instruments funds can be re-allocated among member states (Austria will be among the beneficiaries).

The Agenda 2000 Reform introduced several modifications of the milk market regime. As of 2004, milk prices will to be lowered and the introduction of a premium per tonne of milk will compensate revenue losses. This premium is to become part of the single farm premium from 2006/07 on. The reformed milk quota system will be maintained until the 2014/15 marketing year.

For cereals (apart from rye), the intervention price remains the same, but the monthly increments will be cut by half. For rye, the intervention price mechanism will be abolished.

In case of protein crops, the current tonnage supplement of € 9.50 will be maintained for overall production and converted into a crop-specific area payment for up to a maximum of 1.4 million hectares. The production refunds for starch will remain in place, the minimum price for starch potatoes will be maintained and 40 % of the direct payment will be integrated in the decoupled single farm payment. A new subsidy (€ 45 per hectare) will be introduced for renewable raw materials and energy crops.

The suckler cow premium for Austria is increased by 50,000 entitlements. These animals are deducted from the Austrian regional ceiling of special bull and steer premium (the regional ceiling of special premiums will be reduced accordingly). The premiums will probably be allocated among farmers who have bred heifers during the reference period.

3. Simulating the effects of decoupling and the reform of common market organisations

3.1 The Positive Agricultural Sector Model Austria - PASMA

PASMA is employed to estimate the effects of the CAP reform on farm income, crop and livestock production, and farm labour at regional and national scales. Data from Allgemeines Land- und Forstwirtschaftliches Informationssystem (ALFIS), Integrated Administration and Control System (IACS), Economic Agricultural Account (EAA), Agricultural Structural Census (ASC), the Standard Gross Margin Catalogue, and Standard Farm Labour Estimates provide necessary information on resource and production endowments for 40 regional and structural production units. Consequently, PASMA is capable to estimate production, labour, and income responses for each single unit. Such a broad regional differentiation allows flexible aggregation in the model and its results (e.g., federal states or major production regions, and alpine farming zones). PASMA is calibrated to historic crop and livestock activities by using the method of Positive Mathematical Programming (PMP). Howitt (1995) has initially published PMP and since then it has been modified and applied in several models e.g., Lee and Howitt (1996), Paris and Arafini (1995), Heckeley and Britz (1999), Cypris (2000), Röhm (2001), Röhm and Dabbert (2003). In PASMA,

linear approximation techniques are utilized to mimic the non-linear PMP approach. Thus large scale models can be solved in reasonable time. In combination with an aggregation procedure, i.e., building convex combinations of historical crop mixes (Dantzig and Wolfe, 1961; McCarl, 1982; Önal and McCarl, 1989, 1991), the model is robust in its use and results.

PASMA is a set of three almost identical Linear Programming (LP) models. The purpose of the first one is to assign all potential activities in crop and livestock production. For instance, the area of meadows is recorded in various data sources listed above. However, information on which activities are actually carried out and to what extent are not available (e.g., grazing, hay, silage, or green fodder production). These activities are accordingly assigned in the model using historical livestock records and detailed feed balances. In the second LP are the perturbations coefficients (Howitt, 1995) incorporated to compute the calibration coefficients of a linear marginal cost curve primarily following Röhm and Dabbert (2003). The third LP is the actual policy simulation model. Calibration coefficients are built in using linear approximation techniques that allow calibration of crop and livestock production activities to observed and estimated shares. Other model features such as convex combinations of crop mixes, and converting, building, or giving-up livestock stands are included to allow reasonable responses in crop and livestock production.

Total producer surplus from crop and livestock production and policy payments is maximized subject to regional resource endowments, and transfers i.e., land, livestock, and farm labour. PASMA differentiates production activities with respect to:

- 19 land categories (arable land, alpine pastures, forest, etc.),
- 36 cash crops (wheat, corn, vegetables, etc.),
- 48 feeding activities and crops (grazing, silage, hay, etc.),
- conventional or organic production systems (crop and livestock),
- 32 management measures from the Austrian Agri-Environmental Programme ÖPUL (cover crops, etc.),
- 29 livestock categories (dairy, suckler cow, pigs, sheep, etc.), and
- 34 livestock products (milk, meat, wool, eggs, etc.).

All these activities are available in each of the 40 regional and structural production units. Feed and fertiliser balances assure transfers between crop and livestock activities within each production unit.

Separate feed balances are available for forage and concentrates, winter and summer feed rations, as well as for organic and conventional farming systems. Similarly, manure from livestock production and commercial fertilizer are transferred to crop activities. A comprehensive transport matrix allows transfers of crops (concentrates, hay etc.), and animals (piglets, calves, heifers, etc.) between all 40 regions. In addition, imports of crops (e.g., soybeans) and animals (e.g., heifers, calves) are also considered in the model. Product prices and other model assumptions are referenced in Sinabell and Schmid (2003a, 2003b, 2003c).

3.2 Estimates of standardized labour demand of the Austrian agricultural sector.

Farm labour supply and demand are difficult to measure. Existing estimates based on census or surveys and statistics of persons covered by farmer's social security show rather large differences (Puwwein, 1996). Results are typically depending on details of the instrument to measure farm labour.

Greimel et al. (2002) presented estimates on farm labour for the Austrian agricultural sector using a very different approach. They use a method of standardized labour requirements for typical agricultural production activities. Standard production procedures were defined for crop and forage production and animal husbandry. A standard labour requirement is defined according to single operations and summed up to give the total per activity. The total labour requirement of all activities on a farm reveals the total standard labour requirement per farm.

Several assumptions need to be made to make such a procedure operational (standard mechanisation, average skills of farmers, average farm/field distances, etc.). However, using very detailed farm level data from IACS, the authors were able to reduce the need for assumptions to a minimum. The estimates account for farm specific field sizes, the steepness of slopes and organic farming management.

Based on 2001 data approximately 200 Mio. hours of farm labour were employed in the Austrian agricultural sector according to this approach (Stadler et al., 2002). Only one quarter of this time is spent in crop and forage production, most of the time is used for animal husbandry. However, not all farm activities can be estimated equally well

(e.g., vegetable and wine production are not covered as detailed as the other activities).

Data from this analysis were made available (Stadler, 2003), and include even most recent estimates of very specific activities (alpine grassland management, intensive fruit production, etc.).

3.3 Scenario analyses

To evaluate the consequences of decoupling direct payments from production, model simulations are used to estimate producer surplus and factor demand. The underlying results were obtained at the level of the nine Austrian federal states and aggregated at the national scale. Results of three different price scenarios were compared to a reference situation, followed by computing percentage deviations (Table 1).

The reference situation is defined as the continuation of the Agenda 2000 reform in 2008/09. This reform is not yet fully implemented, because several modifications of the milk market regime are planned to be applied in 2005. Therefore, the reference scenario also needed to be simulated. The findings reported below are therefore comparisons of PASMA simulations.

The reform will reduce the demand for farm labour employed in agricultural production by approximately 2 % until 2008 relative to the reference scenario (continuation of Agenda 2000-reform). Therefore structural adjustment will be accelerated slightly.

Income differences are partly due to different assumptions about farm commodity prices in 2008/09. Higher farm commodity prices will likely lead to more positive income effects. The effects of the Fischler reform 2003 on the income of the Austrian agricultural sector are within a range of +1 % to -2 %.

By relating the income indicator to the number of hours spent for production, it is possible to estimate an average income per labour unit. Incomes per labour unit will increase even under low price expectations. Modulation (transfers shifted among countries and farms after the 2003-reform) will make additional extra funds available to Austrian agriculture (Pröll, 2003). Farm incomes therefore might further increase, although the extent depends on the choice of actual measures and its effect on structural adjustment.

In each of the price scenarios, farm output declines due to decoupling. The output of beef is likely to decline by over 10 %, although part of

the reduction is due to lower prices. The reduction of output is complemented by lower costs of some inputs. The output of other livestock products will not change significantly (at a regional scale some specialisation can be observed). Crop output will decrease similar to the 4 % reduction in arable land use. Farm labour demand will decline at a much lower pace. This is due to the shift in production patterns. Production methods which are relatively extensive concerning all inputs except labour are becoming more attractive due to the Austrian Agri-Environmental Programme ÖPUL (e.g., organic farming).

Table 1: Percentage change of selected indicators under complete implementation of decoupled single farm payment versus continuation of the Agenda 2000 reform

	Expected Price Trends		
	optimistic	average	pessimistic
<i>farm labour demand</i>	- 1	- 2	- 2
<i>producer surplus</i>			
agricultural sector	+ 1	± 0	- 2
per labour unit	+ 3	+ 2	+ 1
<i>variable cost</i>			
livestock production	- 6	- 8	≤ - 10
crop production	- 3	- 3	- 4
<i>hectares arable land</i>	- 4	- 4	- 4
<i>output (volume)</i>			
beef	≤ - 10	≤ - 10	≤ - 10
other meat	± 0	± 0	± 0
eggs	± 0	± 0	± 0
milk within quota	± 0	± 0	± 0

Source: own calculations. Assumptions: Time horizon 2008-09. 50,000 additional suckler cow premium entitlements are shared among owners of heifers. Additional funds for the programme of rural development (€ 17 million annually) are not accounted for in total transfers.

Land use will change considerably once the reform is fully implemented. The share of arable land will decline and the share of extensively used grassland will increase. Without the obligation to keep land in production we would expect to see a considerable share of agricultural land gradually turn into forest.

3.4 Partially decoupling of direct payments

Due to the compromise of the Greek Presidency, member states can partially implement the reform within certain limits. These limits are defined by the fact that only small deviations from fully decoupling direct payments will be possible. Four of these options were investigated in the model analysis. According to the agreement of farm ministers, several of these options can be combined or even implemented only at a regional scale. They were, however, analysed separately in order to show the isolated impact of each of these options. Future analysis could include regional differentiation.

At sector level, partially decoupling direct payments has only a marginal effect on farm income at sector level (Table 2). There are only two cases where a slight increase of aggregate income can be identified. A significant difference between incomes per farm labour unit could not be found among the four scenarios. The model shows that slightly more labour is needed for production in the two scenarios with income increases at sector level.

Retaining 25 % of the premiums coupled to the production of arable crops leads to an increase of approximately 1 % point of arable crop output compared to the fully decoupled case. The effects on the output of beef differ between the scenarios in the livestock sector. The decline of beef production is minimised if the special bull and steer premium is not decoupled. In addition, the more premiums are decoupled, the less operating inputs will be purchased (i.e., incentive for extensification).

The effects on farm labour demand for agricultural production are reported in Table 3. To account for the regional differences, the figures are listed for the Austrian federal states. In total, the effects are relatively low (below 1 % in any case). Therefore partial implementation has only minor effects on farm labour demand. If we assume that 1,800 hours are equivalent to one Labour Unit (LU) we would expect that about 300 to 400 persons more would remain on farms due to partial implementation at national scale. In some regions, however, farm labour declines if decoupling is only implemented at a partial level.

Measured in absolute terms the decline in farm labour due the CAP 2003 reform is likely to be equivalent to approximately 2,000 LUs if direct payments are fully decoupled. The employment effect by partially decoupling is relevant; however, the extent is only minor.

Table 2: Percentage change of selected indicators under four MTR options versus continuation of the Agenda 2000 reform

	MTR options of partially coupled premiums			
	25 % crop prem.	100 % suckler cow & 40 % slaughter prem.	100 % slaughter prem.	75 % bull prem.
<i>farm labour demand</i>	- 1	- 1	- 1	- 1
<i>producer surplus</i>				
agricultural sector	± 0	+ 1	+ 1	± 0
per labour unit	+ 2	+ 2	+ 2	+ 2
<i>variable cost</i>				
livestock production	- 8	- 5	- 6	- 6
crop production	- 3	- 3	- 3	- 3
<i>hectares arable land</i>	- 3	- 4	- 4	- 4
<i>output (volume)</i>				
beef	≤ - 10	- 8	- 10	- 7
other meat	± 0	± 0	± 0	± 0
eggs	± 0	± 0	± 0	± 0
milk within quota	± 0	± 0	± 0	± 0

Source: own calculations. prem. = premium. Assumptions: Time horizon 2008-09; average price expectation. 50,000 additional suckler cow premium entitlements are shared among owners of heifers. Options are analysed separately. The supplementary refund is accounted for as the slaughter premium. Additional funds for the programme of rural development (€17 million annually) are not accounted for in total transfers.

Employment in the Austrian agricultural sector has been continuously declining. The annual rate of decline for the farm sector is approximately 4,400 LUs since 1995. This rate is recently smaller with approximately 2,000 LU in 2000 and 2001 (Sinabell, 2003).

Considering that the CAP-reform will be implemented over several years, the induced pressure on structural adjustment is surprisingly low. The effects on farm labour demand due to partial implementation of decoupled premiums probably can only be measured by tools like the model used here.

Table 3: *Percentage change of farm labour demand under four MTR options versus continuation of the Agenda 2000 reform*

	MTR options of partially coupled premiums			
	25 % crop prem.	100 % suckler cow & 40 % slaughter prem.	100 % slaughter prem.	75 % bull prem.
Burgenland	+ 0.05	+ 0.02	+ 0.03	± 0.00
Carinthia	+ 0.12	+ 0.87	+ 0.54	+ 0.19
Lower Austria	+ 0.27	+ 0.32	+ 0.34	+ 0.32
Upper Austria	+ 0.92	+ 0.19	+ 0.54	+ 0.34
Salzburg	+ 0.05	+ 0.12	+ 0.40	+ 0.26
Styria	- 0.18	+ 0.12	+ 0.19	+ 0.07
Tyrol	- 0.03	+ 0.59	+ 0.04	+ 0.13
Voralberg	- 0.49	- 0.12	+ 0.42	- 0.13
Vienna	+ 0.59	+ 0.01	+ 0.02	± 0.00
Austria	+ 0.25	+ 0.28	+ 0.33	+ 0.22

Source: own calculations. prem. = premium. Assumptions: Time horizon 2008-09, average price expectation. 50,000 additional suckler cow premium entitlements are shared among owners of heifers. Options are analysed separately. The supplementary refund is accounted for as the slaughter premium. Additional funds for the programme of rural development (€17 million annually) are not accounted for in total transfers.

4. Discussion

Model simulations show that compared to a business-as-usual scenario (continuation of the Agenda 2000 reform of 1999) the CAP reform will:

- slightly accelerate structural adjustment (which means fewer people employed in agricultural production),
- have only minor effects on the expected aggregate farm income, and
- lead to less intensive farming practices that will reduce crop and beef outputs.

The reform allows member states considerably leeway to design their own CAP version that will better meet their own vision of agricultural policy. A likely effect of the reform will be a decline in the output of beef. By partly coupling some of the premiums (most effectively, by retaining the special premium for bulls and steers) some of the reduction could be prevented.

Compared to the effects on output and land allocation the effects on farm labour employment are only minor if direct payments are only partially decoupled. According to our estimates approximately 300 to 400 additional annual labour units can be retained in the agricultural production sector (at level of 165,000 LU in Austria in 2001). Although Austria has a comparably unfavourable farm structure mainly due to natural disadvantages, partial decoupling would not necessarily prevent structural adjustments.

Many variables relevant for the supply of agricultural labour (e.g., opportunity cost of labour in agriculture) are not accounted for in this demand analysis. Apart from this, there are several reasons to assume that these figures are at the lower level of the actual range:

- standard labour requirements are considerably lower than other farm records reveal (Greimel et al., 2002 report that actual book keeping farms use 3,892 hours of labour compared to their estimate of 1,973 hours per year; this gap is partly due to the fact that some activities like fruit and wine production were not yet covered in their study),
- in the model, farm labour is assumed to be infinitely divisible; in reality this is not possible therefore the adjustment in reality will not be as smooth as in our results
- other farm activities (e.g., agro-tourism, self-marketing, machinery co-operations) are currently not considered in PASMA, and
- time for general farm management is not included in standard labour requirements, yet.

Partially decoupling of direct payments is likely to have several spurious effects compared to fully decoupling:

- the administrative burden is likely to be higher,
- the number of decision variables is higher, making decisions more complex to evaluate new optimal production regimes, and
- the effects on competitiveness are likely to be detrimental because coupled premiums induce biased signals off the markets.

Particularly information technology and extension services could be used to deal with the first two effects. In case that Austria or other small countries would opt for partially decoupling it would have little influence on EU market prices. However, the situation changes if large countries such as Germany, Italy or France would stick to coupled direct payments.

References

- CYPRIS, C. (2000): Positive Mathematische Programmierung (PMP) im Agrarsektormodell Raumis. Schriftenreihe der Forschungsgesellschaft für Agrarpolitik und Agrarsoziologie, Bonn, 313.
- DANTZIG, G.B. AND P. WOLFE (1961): The Decomposition Algorithm for Linear Programs. *Econometrica*, **29**, 767-778.
- EUROPEAN COMMISSION (2003): Proposal for a Council Regulation establishing common rules for direct support schemes under the common agricultural policy and support schemes for producers of certain crops; Proposal for a Council Regulation amending Regulation (EC) No 1257/1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF) and repealing Regulation (EC) No 2826/2000; Proposal for a Council Regulation on the common organisation of the market in cereals; Proposal for a Council Regulation on the common organisation of the market in rice; Proposal for a Council Regulation on the common organisation of the market in dried fodder for the marketing years 2004-05 to 2007-08; Proposal for a Council Regulation amending Regulation (EC) No 1255/1999 on the common organisation of the market in milk and milk products; Proposal for a Council Regulation establishing a levy in the milk and milk-products sector. COM (2003) 23 final, Brussels, 2003, http://europa.eu.int/comm/agriculture/mtr/index_en.htm.
- FISCHLER, F. (2003A): GAP Reform, eine Langzeitperspektive für eine nachhaltige Landwirtschaft, COMAGRI – Ausschuss für Landwirtschaft, Speech/03/20, Brussels, 2003.
- FISCHLER, F. (2003B): Speech delivered at the CAP Reform Committee on Agriculture and Rural Development, Brussels, 2003, Press Release Rapid, DN: SPEECH/03/356, Date: 9 July 2003, http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=SPEECH/03/356|0|RAPID&lg=EN&display=.
- GREEK PRESIDENCY (2003): Presidency Compromise in Agreement with the Commission. <http://register.consilium.eu.int/pdf/en/03/st10/st10961en03.pdf>.
- GREIMEL, M., F. HANDLER, und E. BLUMAUER (2002): Arbeitszeitbedarf in der österreichischen Landwirtschaft, Forschungsbericht der Bundesanstalt für alpenländische Landwirtschaft und der Bundesanstalt für Landtechnik, Irdning und Wieselburg.
- HECKELEI, T. UND W. BRITZ (1999): Maximum Entropy Specification of PMP in CAPRI. CAPRI Working Paper, University of Bonn.
- HOWITT, R.E. (1995): Positive Mathematical Programming. *American Journal of Agricultural Economics*, **77**, 329-342.
- LEE, D.J. AND R.E. HOWITT (1996): Modelling Regional Agricultural Production and Salinity Control Alternatives for Water Quality Policy Analysis. *American Journal of Agricultural Economics*, **78**, 41-53.
- MCCARL, B.A. (1982): Cropping Activities in Agricultural Sector Models: A Methodological Proposal. *American Journal of Agricultural Economics*, **64**, 768-772.

- ÖNAL, H. AND B.A. MCCARL (1989): Aggregation of Heterogeneous Firms in Mathematical Programming Models. *European Journal of Agricultural Economics*, **16**, 4, 499-513.
- ÖNAL, H. AND B.A. MCCARL (1991): Exact Aggregation in Mathematical Programming Sector Models. *Canadian Journal of Agricultural Economics*, **39**, 319-334.
- PARIS, Q. AND F. ARFINI (1995): A Positive Mathematical Programming Model for the Analysis of Regional Agricultural Policies. Proceedings of the 40th Seminar of the European Association of Agricultural Economists, Ancona.
- PRÖLL, J. (2003): Absicherung österreichischer Interessen bei Agrarreform ist gelungen. AIZ, 27 June 2003.
- PUWEIN, W. (1996): Arbeitskräfte in Österreichs Land- und Forstwirtschaft, WIFO-Monatsberichte **69**, 9, 601-611.
- RÖHM, O. (2001): Analyse der Produktions- und Einkommenseffekte von Agrarumweltprogrammen unter Verwendung einer weiterentwickelten Form der Positiven Quadratischen Programmierung. Schaker Verlag, Aachen.
- RÖHM, O. UND S. DABBERT (2003): Integrating Agri-Environmental Programs into Regional Production Models: An Extension of Positive Mathematical Programming. *American Journal of Agricultural Economics*, **85**, 254-265.
- SINABELL, F. (2003): Einkommensrückgang in der Landwirtschaft nach der Erholung im Vorjahr. in Scheiblecker, M., et al., Österreichs Wirtschaft im Jahr 2002: Neuerlich ungenügendes Wachstum. WIFO-Monatsberichte, **76**, 4, 315-320. http://publikationen.wifo.ac.at/pls/wifosite/wifosite.wifo_search.get_abstract_type?p_language=1&pubid=23875.
- SINABELL, F. UND E. SCHMID (2003A): Entkopplung der Direktzahlungen. Konsequenzen für Österreichs Landwirtschaft. WIFO-Forschungsendbericht, Wien. http://titan.wsr.ac.at/wifosite/wifosite.get_abstract_type?p_language=1&pubid=23706.
- SINABELL, F. UND E. SCHMID (2003B): Die Reform der Gemeinsamen Agrarpolitik der EU: Wichtige Konsequenzen für Österreichs Landwirtschaft. WIFO-Monatsberichte, **6**, 425-440.
- SINABELL, F. UND E. SCHMID (2003C): The Reform of the Common Agricultural Policy. Consequences for the Austrian Agricultural Sector. *Austrian Economic Quarterly*, **3**, 84-101.
- STADLER, M. (2003): Farm labour data set, mimeo.
- STADLER, M., M. GREIMEL, F. HANDLER, UND E. BLUMAUER (2002): Arbeitszeitbedarf in der österreichischen Landwirtschaft und deren mögliche Integration in die Förderpolitik. Paper presented at the 12th ÖGA Conference, Vienna on 26-27 September, 2002.

Affiliation

DI Dr. Erwin Schmid
Institute of Economics, Politics and Law
University of Natural Resources and Applied Life Sciences Vienna
Feistmantelstrasse 4
A-1180 Vienna
Tel.: +43 1 47654-3653
eMail: erwin.schmid@boku.ac.at

DI Franz Sinabell
Austrian Institute of Economic Research
P.O.Box 91, Arsenal OBJEKT 20
A-1103 Vienna
Tel.: +43 1 7982601-481
eMail: franz.sinabell@wifo.ac.at