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Going micro: Analysing SAM multipliers for the dairy chain on Reunion Island

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Abstract— This poster presents a study on the multiplier effects in the dairy chain on Reunion Island. This Indian Ocean island is one of the French overseas departments. However, it struggles with similar problems as the developing areas in its neighbourhood, high levels of unemployment especially being a major concern. The agricultural sector justifies the state support it receives by stressing its role in the creation of employment and economic activity. Our focus is on the dairy sector of the Island, which is relatively recent and highly organized. Local milk production has increased over the years and our aim is to calculate the economy-wide impact of this trend. We use a social accounting matrix with disaggregated accounts for the dairy sector to calculate the impact of changes in this sector.

Keywords— Dairy, SAM, La Réunion.

I. INTRODUCTION

Reunion Island is one of the French overseas departments in the Indian Ocean. The island once thrived from sugar cane plantations of which the derived products still are the main agricultural export products. Today, tourism and financial aid from the French government support the economy [1]. Despite the governmental support, the island faces many challenges, amongst which high population growth resulting in significant levels of unemployment and increased population pressure on coastal cities and inland areas alike. Furthermore, because much of the food and other consumables on the island are imported, the economy may be hardly hit by the rising oil prices. This motivates our interest in the potential linkage effects of agricultural growth. A rise in agricultural activity should contribute to the livelihoods of farmer households but also create jobs on the farm and in up- and downstream sectors.

In the latest World Bank Report (2007)[2] a distinction is made between economies that are agricultural-based, in transition or urbanised. The agricultural sector on Reunion

seems to have characteristics of both a transition and an urbanised economy. On the one hand, the agricultural sector is small and urbanised; it contributes about 2% to the value added produced on the island [3]. Yet, on the other hand, some sectors within agriculture are growing in importance similar to transition economies. Production or area in use or both of vegetables, fruits, poultry, and milk have increased. In this paper we focus on the potential effects of this growth and focus on the dairy sector. Our aim is to estimate the multiplier effects of change in the dairy chain on its actors and on other sectors in the economy. In other words, we search to quantify forward and backward linkage effects using a multiplier approach. It should be noticed that instead of taxing the agricultural sector as is done in many developing and transition countries, agriculture on Reunion is strongly supported by the government.

The different actors in the supply chain consider that the local dairy sector on Reunion can expand its market share. There is a market demand for local milk products, and the milk quota attributed to the overseas departments is far from being reached. The milk quota for the overseas French departments has been raised to 40 million tons [4]. It is worth noting that the European Commission is currently developing a phasing out of the milk quota; therefore it might become a less relevant 'target' for Reunion's milk production. However, the quota remains important for the governmental support that is paid per litre of milk as long as this quota has not been reached.

Data on the different actors of Reunion's dairy chain is used for disaggregating the dairy activity/commodity in a Social Accounting Matrix (SAM). Such a SAM gives a snapshot of the money flows between the sectors of an economy and provides a straightforward method to calculate fixed-price multipliers.

This study on Reunion Island is unique for a number of reasons. First, agriculture has potential to grow in importance. Whether this would be possible without governmental support is a matter for further investigation, with the support and state structure being the major differences between Reunion and its developing neighbours.

Our matrix should give an indication on the importance of subsidies for the development of the dairy sector or the other way round show what would be the effect of future policy reforms that will remove these subsidies. Second, as will be explained below, the organisation of the dairy chain on the island is distinctive. The milk chain at Reunion is highly organized and streamlined by an inter-professional association [4, 5]. Formal arrangements and social capital add to the strength of the dairy chain. Third, the economy has natural borders, which enables to capture internal product and money flows, exports and imports.

In the next section we give a short overview of the characteristics of the dairy sector on Reunion. This is followed by a brief description of the methodology. Results are described and discussed next. Finally we conclude.

II. ORGANISATION OF THE MILK CHAIN

In 1962 a cooperative of dairy farmers started as the SICA-Lait, or *Société cooperative d'intérêt collectif de lait* [3, 4]. Its major activities were the collection, bulking and processing of local milk. In 1972 the processing of milk and commercialisation of dairy products was taken over by CILAM (*Compagnie Laitière des Mascareignes*). From then on, SICA-Lait devoted its activities to the collection of milk and the provision of material and technical support to milk farmers [4].

Almost all milk produced on the island is collected by SICA-Lait. It is tested on fat and protein content, bacterial and somatic cell count and farmers regularly receive accounts of the quality of milk they supply. If the bacterial quality of the milk is satisfactory for three months in a row, the farmers receive a premium, which should be an incentive for the farmers to invest in milk quality.

The milk collected and bulked by SICA-Lait is mainly sold to CILAM for processing, into UHT bricks, yoghurt, and cheese. Local milk may be mixed with imported milk powder in the final product. To target consumers with a preference for locally produced milk, CILAM has developed a particular brand 'Piton des Neiges' (referring to the highest mountain on the island). Furthermore, CILAM has acquired the brand name 'Yoplait' for Reunion. Sorelait (*Société Réunionnaise Laitière*) is the second dairy processor on the island, importing milk powder to process mainly into yoghurt (marketed as 'Danone').

It is estimated that 75 percent of the milk and cheese products consumed on Reunion are imported. The total milk consumption (in milk equivalent, calculated as the sum of total imported (customs statistics) and locally produced milk and milk products) on the island averaged 137l/person in 2005, far below the metropole level of 330 l/person [6].

The volume of imported milk and milk products is estimated at 17 080 tons; imported mainly from metropolitan France (94%) with the remainder imported from the Netherlands (3.5%), Belgium (1.4%) and Germany (1%).

Large supermarket chains, such as Carrefour, Casino and Géant, have recently invested in different retail outlets on the Island. They buy dairy products such as UHT milk, yoghurt, ice cream and cheese from CILAM and Sorelait, which are put on the shelves alongside imported products. Butter, for example, is not produced on Reunion.

Feed for cows, such as concentrates, are mainly supplied by URCOOPA/Sanders. Urcoopa is the union of agricultural cooperatives on Reunion Island and specializes in animal nutrition and feed concentrate supply. Additional cane straw and hay are supplied by sugar cane farmers to overcome seasonal forage deficits.

Culled cows and male calves are sold to SICA-Revie (*Société cooperative d'intérêt collectif agricole Réunion-Viande*) and Sica-bat (*Société cooperative d'intérêt collectif agricole d'abattage*) to be slaughtered. Female calves are kept on the farm to be raised into heifers or sold to SICA-Lait. The latter has its farm on which heifers are raised, inseminated and sold back to the farmers. SICA-Lait has invested in an own farm for at least two reasons. On the one hand it wanted to prevent female calves being sold for slaughter, which might lead to a shortage of heifers and create a parallel market. The annual raising of a herd of heifers enables SICA-Lait to provide farmers with cows if they want to enlarge their farm or for new farmers to start a dairy farm. On the other hand, controlling the insemination of heifers guarantees genetic diversity on the island.

ARIBEV (*Association réunionnaise interprofessionnelle pour le bétail et les viandes*) is an inter-professional organisation that regroups all actors within the milk chain. ARIBEV was created in 1975 for the beef, milk and pork chain, and an inter-professional association for the poultry sector started in 1994. These inter-professional associations also include representatives of the distributors and importers who are highly involved in the development of local production. It provides a discussion forum, enables the enforcement of agreements throughout the chain and defends the interests of its members. All associations within ARIBEV represent at least 60% of the local market, giving ARIBEV the possibility to request the Minister of Budget to enforce agreements made within ARIBEV for the whole Island.

ARIBEV hosts the FODELAIT (*Fonds de Développement de l'Élevage Laitier*). FODELAIT was established in 1980s as part of the Poseidom programme. Its main activities are to support milk prices and provide milk quality control and financial support for milk collection.

Poseidom is a special programme created in order to overcome disadvantages because of the ultra-peripheral location and isolation of the overseas departments. Apart for the Poseidom programme, in which the fixed price of milk to farmers is the main characteristic, dairy farmers are supported for several activities and investments. According to EC treaty, Reunion is an outermost region where the EC Objective 1 support applies. See [4] for a detailed overview.

III. METHODOLOGY

As mentioned in the introduction, we developed a Social Accounting Matrix (SAM) in order to calculate the multiplier effects of the dairy sector. A SAM is a simple and efficient way of representing the resource flows within an economy [7].

A SAM generally represents the macro and meso economic accounts of an economic system in order to model the transactions and transfers between the actors in the economic system [8]. Every flow must go from one actor to another within the matrix [9]. Round [8] summarizes the three main features of a SAM as follows: (a) it is a square matrix, with the receipts of each account in a row and the costs in the corresponding column. Totals of corresponding rows and columns must be equal; (b) it is comprehensive because all economic activities of the economic system (consumption, production, accumulation and distribution) are quantified; and (c) it is flexible in the degree of disaggregation and in the emphasis placed on different parts of the economic system.

SAMs have been frequently used to analyse the potential effects of a change in a national, regional or village economy (examples are Pyatt and Round (1979) [10], Parikh and Thorbecke (1996) [11], Taylor and Adelman (1996) [12], Thorbecke and Jung (1996) [13], and Rich *et al.* (1997) [14] to name some). However, disaggregating the agricultural sector with a focus on one particular chain is less common (a SAM has been built for the sugar cane industry [15] and for the poultry industry [16] on Reunion).

A SAM can be used for simple modelling exercises. The effects of exogenous injections or shocks on a whole economic system can be explored using the multipliers derived from the SAM. Exogenous accounts within the matrix are those for which it is assumed that expenditure is set independently from income, and the choice of exogenous accounts dictates the range of shocks that can be studied [17].

The development of the SAM for an island's economy has several analytical advantages. The local economy can be fairly well represented as products are either produced locally or imported by sea or air; the delimitation of the

research area is simply determined by its coasts; and the number of activities is limited, which improves the overall quality of the data.

A SAM is notoriously demanding in data; it has '*a voracious appetite for data*' [8]. Data has to be collected to quantify all flows in the matrix. The SAM in this study is built for 2005 which is considered to be a 'normal' year in the sense that apart from unfavourable weather conditions in the beginning of the year, no unusual events were recorded.

The matrix is built using data from INSEE and the aggregation follows Parrot *et al.* (2004) [16]. In our matrix the dairy account is disaggregated to include the following activities: dairy farming, activities of the cooperative in collecting milk, transformation of local milk, and transformation of milk powder/import of milk products. Other activities related to the chain are production of feeds and slaughtering of unproductive cows and calves. Data was collected on each of these activities by interviewing key-informants throughout the chain. The data was cross-checked with information from the statistical service and previous surveys. The sales of inputs by the cooperative to other farmers outside the dairy chain are allocated to a separate account. It is furthermore assumed that unproductive cows and male calves are slaughtered and sold as meat.

The following commodities of the dairy chain are included in the SAM, namely: raw milk, bulked milk, local dairy products, imported dairy products, imported dairy products sold, female calves, heifers, live animals for slaughter, meat, milk powder and all inputs. The government, capital and rest of world account are considered to be exogenous.

Once the SAM is constructed, a matrix of technical coefficients can be computed; this matrix is subtracted from the unity matrix and inverted to yield the multipliers. These multipliers can be used to capture the direct and indirect linkage effects of shocks in the economic system.

IV. RESULTS

A. *Change in demand of local dairy products*

The multipliers are now used to simulate the effects of changes in the chain. A first simulation was to calculate the outcome changes in the demand for local dairy products which was mimicked by a change in exports. The injection of demand had a significant effect on the total economy, amounting to almost 87 million euro for an increase in local demand by 21 million euro (which is just over doubling the current estimated value of local dairy products).

Also the impact on the local dairy chain (milk farmers, cooperative and transformation industry) was large (35 million euro). However, milk farmers were benefiting relatively less from the increased demand. The increased production of dairy products resulting from the increased demand seemed to benefit the transforming industry where employment was relatively important. These results suggest that the backward (feed) and forward (meat, activities of the cooperative and the transformation industry) sectors of milk farms benefitted more from the increase in demand. The small proportion of raw milk in the value of the dairy products explains this limited multiplier effect on the farms.

B. Potential effects of a decrease in subsidies

As mentioned above, the dairy sector benefits from state support. A farmer receives an extra 0.085 euro per litre as subsidy on top of the price of 0.35 euro per litre. Farmers and the cooperative also benefitted from subsidies to support investments in milk tanks and other equipment, to establish young farmers and to help managing the farm and milk collection (see [4]). Farmers are aware that this support might be reduced in the near future.

In this simulation exercise we 'removed' the subsidies that were entered in our SAM. The results were as follows. We assumed that a reduction of the support to farmers by 3.475 million euro was equivalent to a reduction of the total farm account by the same amount. This resulted in a value decrease by 10.93 and 5.87 million euro over all activities and the dairy chain, respectively. Households would lose 3.23 million euro.

In a second simulation, we reduced the accounts of farmers, the cooperative and the transforming industry by the respective subsidies they received which was estimated at 5.15 million euro. The negative effect on the activities of the economy amounted to a loss of 16.44 million euro, of which 8.9 million euro in the milk chain. The effect on the households was estimated at 4.48 million euro.

V. CONCLUSIONS

The construction of a SAM with a disaggregated dairy sector is useful to analyse the multiplier effects of changes in demand of local dairy products and government support. The results suggest that increased demand of local dairy products may mainly benefit the transformation industry and to a lesser extend the farmers. Furthermore, a removal of subsidies paid to farmers, the cooperative and the transforming industry can have a significant direct and indirect impact. Even if the removal of the support would be

entirely compensated by increased demand for local dairy products, the net effect is estimated to be negative for dairy chain.

The SAM exercise is appropriate to model a small economy such as that of Reunion Island. However, our SAM needs to be developed further and its limitations are to be recognised. For example, our matrix needs to be disaggregated over the different other farm activities as well as the clusters by types of farms. This should enable us to assess the distributional effects of the changes. We also want to add an environmental component to the matrix. Furthermore, there are several limitations of the SAM approach. A SAM is static; changes in prices are not considered and production and consumption elasticities are fixed. Also constant returns to scale are assumed for the underlying production functions. Clearly, more research is needed on the impact of changes in prices or production technology as well as the environmental constraints of increased production. Computable General Equilibrium models could be developed to overcome some these constraints and for more policy analysis.

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