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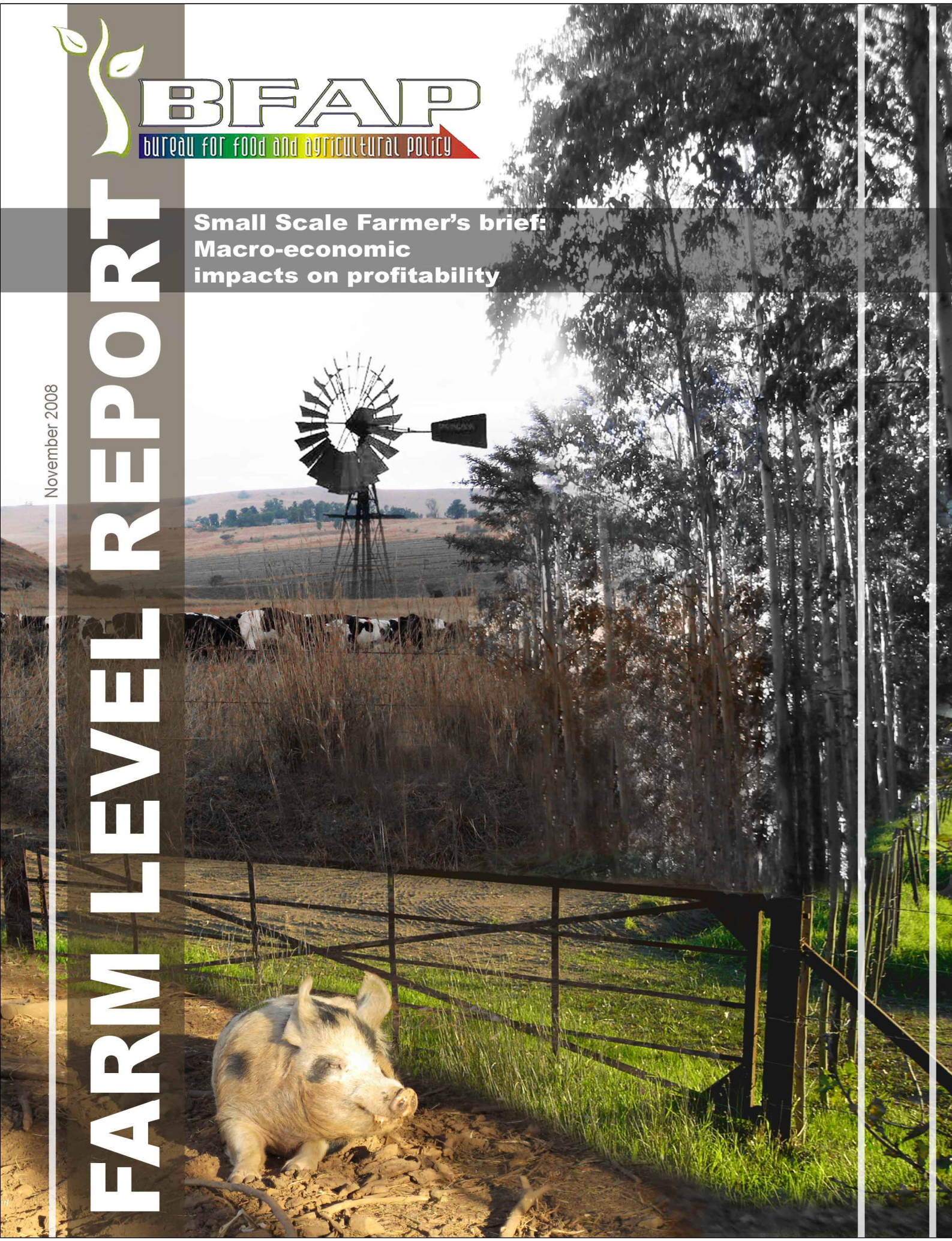
BFAP

bureau for food and agricultural policy

FARM LEVEL REPORT

November 2008

Small Scale Farmer's brief: Macro-economic impacts on profitability



SMALL SCALE FARMER'S BRIEF: MACROECONOMIC IMPACTS ON PROFITABILITY

BFAP BRIEF

NOVEMBER 2008

EXECUTIVE SUMMARY

Small scale farmer settlement and development is one of the key priorities in the National Department of Agriculture's (DoA) Strategic Plan. A number of challenges related to the establishment and development of small farmers are, however, present. Amongst others these challenges include a lack of access to land, financial services, mentorship programs and markets. This brief does not analyse the challenges related to small scale farmer settlement but rather focuses on the development aspect, specifically in the case where small scale farmers have already been successfully established and have to operate in a commercial environment.

A small scale farmer development project in the district of Taung in the North West Province serves as a good example of such a program, where small scale farmers have successfully been established and are producing barley and maize for the commercial market. This project is a public-private partnership between the North West Provincial Government, South African Breweries (SAB) and South African Breweries Maltings (SABM). These small scale farmers have access to land, financial services and mentorship programs, and have markets where their produce can be delivered. The initial challenges of being established have thus been overcome, but now these farmers face the reality of producing on a sustainable basis in the commercial market environment where the exposure to external drivers is very high.

The first important fact to mention is that the farmers who form part of this project do not own the land or the irrigation equipment on the land. This implies that their fixed cost component is very low and that high interest rates will not have a large negative impact on farm profitability. However, from the actual farm-level data over the past three years it is interesting to note that there exists a general trend that these farmers do not re-invest to a great extent in their farming operations, apart from sporadic replacement of machinery and tools. It can be argued that because they do not own the land they do not have the necessary incentives to re-invest their profits. This implies that the long-run sustainability

of these farmers is dependant on the existence of the public-private partnership between the provincial government, SAB and SABM.

The aim of this brief is, firstly, to construct and model a typical small scale irrigation farm for the Taung project based on data received from SAB/SABM. A set of scenarios is then simulated to determine the potential impact and sensitivity of a small scale farm's profitability to changes in a few selected exogenous factors. The modelling results show that the Net Farm Income (NFI) of the farm is most sensitive to an appreciating Rand/$ exchange rate (elasticity = -1.72), and least sensitive to a lower oil price (elasticity = 0.05). Improvement in maize yields also has a significantly positive impact on farm profitability: NFI increases by 1.37 % for every 1 % improvement in maize yields.

Acknowledgement: The support and data contribution of South African Breweries (SAB) and South African Breweries Maltings (SABM) in completing this report is hereby acknowledged.

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1. Introduction and background

The National Agricultural Marketing Council (NAMC) expressed the need to better understand the potential impacts of different macroeconomic variables on the profitability of small scale farmers in South Africa. In order to simulate the potential impacts of macroeconomic variables and develop a modelling framework, good farm-level data is required. In South African agriculture good farm-level data for small scale farmers is hard to come by and only a few pockets of information exist which are, in most cases, developed and maintained by public-private partnerships for a specific project. One good example is the project in the Taung irrigation area in the North West Province, where the North West Government (Department of Agriculture, Conservation and Environment), South African Breweries (SAB) and South African Breweries Maltings (SABM) operates in a public-private partnership. SAB/SABM became involved in the project in 1991, and since then the number of farmers forming part of this public-private partnership has grown significantly.

Over the past two years the Bureau for Food and Agricultural Policy (BFAP) has worked closely with SAB/SABM to better understand the typical small scale irrigation farm in the Taung project, in order to develop a typical farm-level model that can be utilised to simulate and analyse the potential impact of a range of market or policy related scenarios. It is important to note that a typical farm is not constructed by simply calculating averages for the different variables on production, prices and costs, but rather on the basis of what is representative. The BFAP farm-level model[1] serves as the modelling framework to develop this typical small scale farm. Once a five-year outlook for the Net Farm Income (NFI) of this typical farm is generated, based on simulations by the BFAP sector model, this brief then analyses the sensitivity of the farm's profitability to changes in the oil price, the exchange rate and the maize yield.

[1] For more information on the BFAP farm and sector model, visit www.bfap.co.za

2. Farm background and structure

A typical farm unit on the Taung project produces mainly barley and maize under pivot irrigation on land provided by the North West Provincial government. The pivots are maintained by the North West Department of Agriculture, Conservation and Environment, while the farmer is responsible for minor repairs and the replacement of electrical cable in the case of cable theft. SAB/SABM provides off-take contracts to the farmers for both the barley and maize, hence providing the farmers with a secure and stable market in return for acceptable quality of, and quantities of, barley and maize.

A typical farm unit consists of 10 hectares under pivot irrigation. The assumed production model, or system, followed by a typical farm unit is based on the most general production system used on the project, and entails the following: the farmer plants 10 ha of maize during November/December and harvests it during May/June of the following year. Following the maize, 10 ha of barley is planted during June/July and harvested during November/December. Inputs such as seed, fertiliser, herbicide, insecticide and lime are supplied through contracted suppliers. These suppliers are contracted by SAB/SABM on behalf of all the small scale farmers that take part in this production scheme. SAB/SABM is therefore in a position to negotiate better prices through acquiring discounts based on the large quantities of inputs that are bought by the small scale farmers.

Independent contractors are sourced by SAB/SABM on behalf of a small scale farmer to cultivate the 10 ha of land. This relieves the pressure on the small scale farmer to make fixed investments in expensive equipment and also decreases the cost of financing, since the farmer does not need to buy equipment. The result is that the fixed cost component of the farmer is much lower than the general norm on larger farms. However, the production cost component of contractor usage is higher than the norm due to the extensive usage of contractors in terms of preparing the fields and planting, spraying, harvesting and transporting the crops.

In figures 1 and 2 the average input cost structures for both maize and barley for the period 2005 to 2007 are presented. These figures are based on actual data compiled by SAB/SABM.

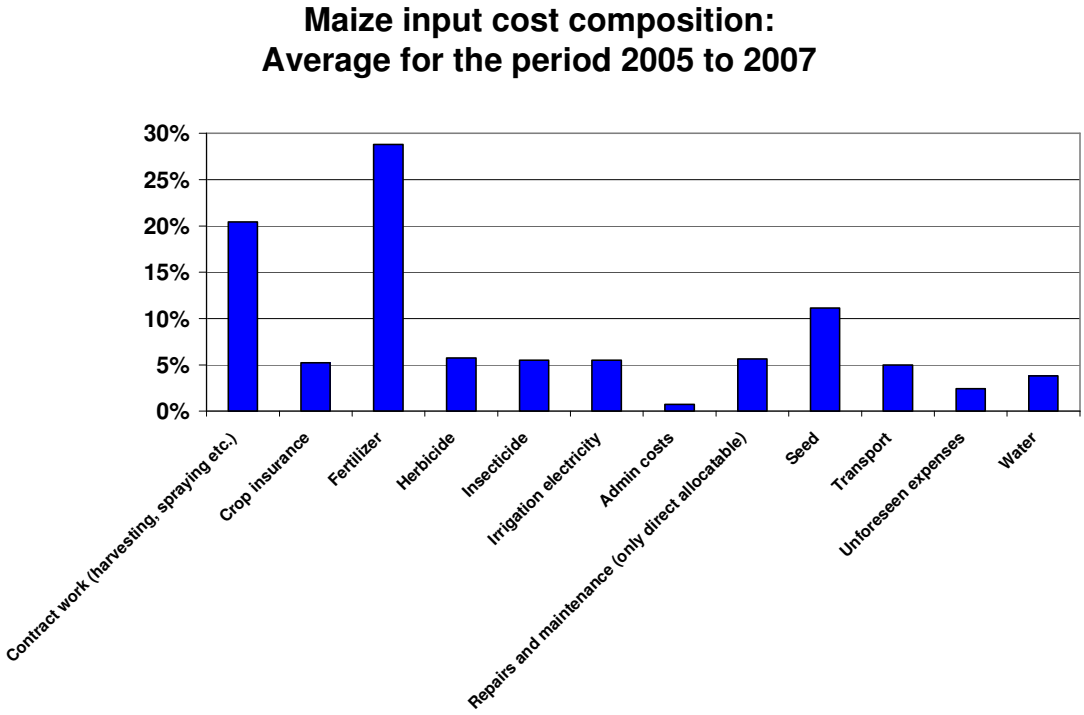

Figure 1: Maize input cost composition (*Source: SAB, 2008*)

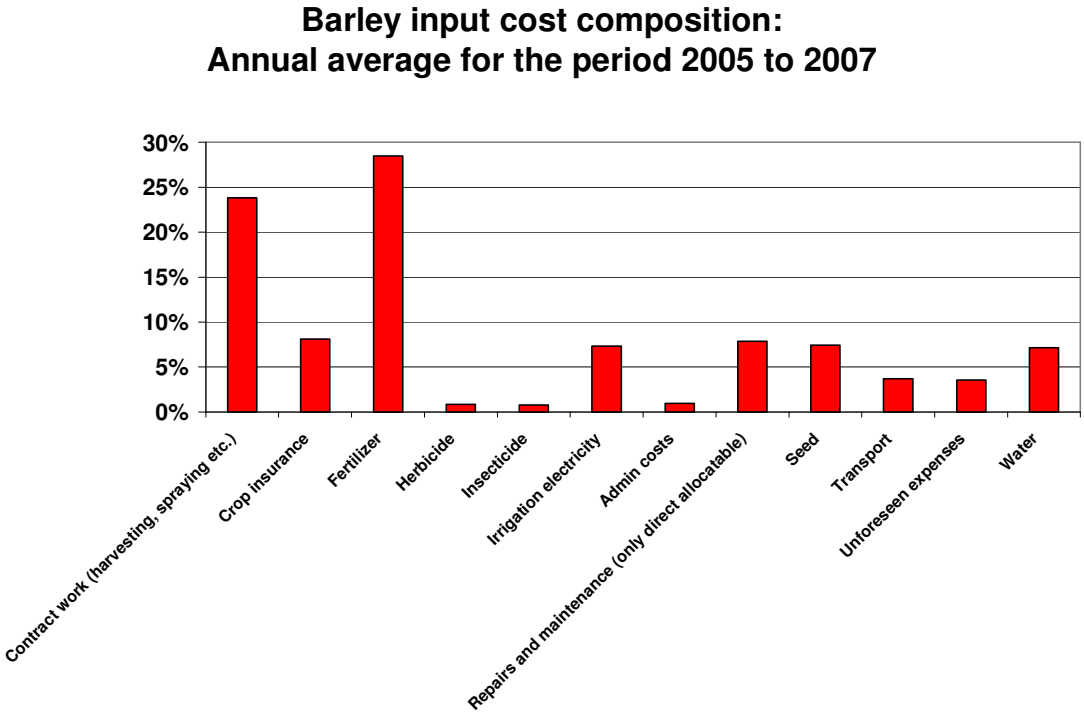

Figure 2: Barley input cost composition (*Source: SAB, 2008*)

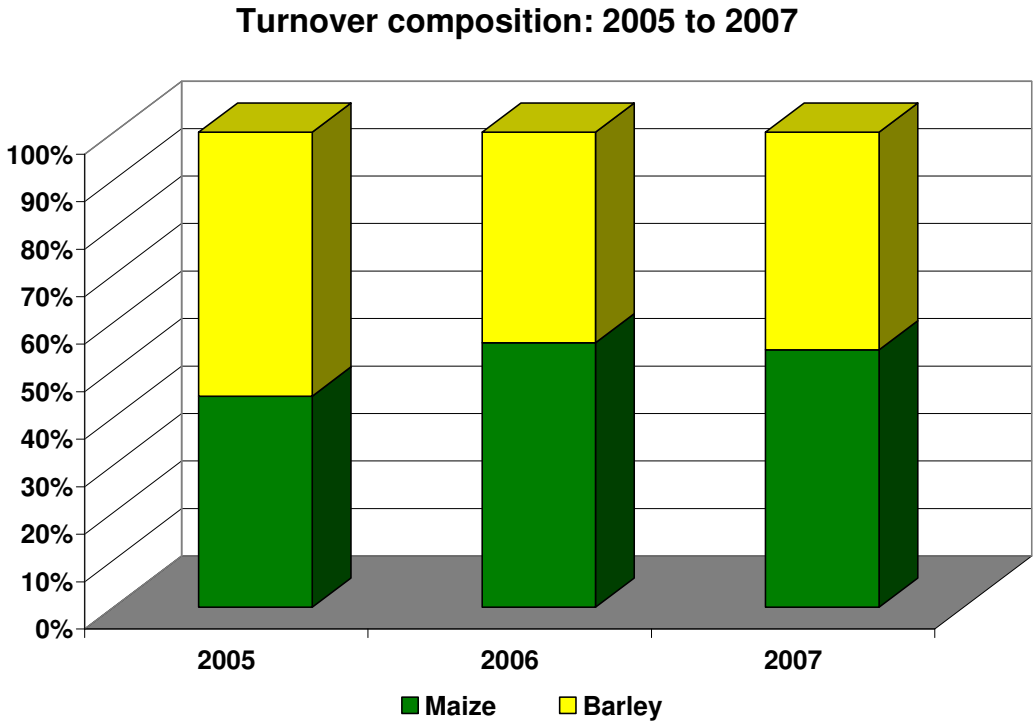

Figure 3: Total farm turnover composition (*Source: SAB, 2008*)

In figure 3 the turnover composition of a typical farm is presented. During 2005 income from maize was much lower than normal due to adverse weather conditions that resulted in below average maize yields and extremely low maize prices due to a domestic surplus of maize produced. This caused barley to be the major contributor to turnover for 2005. However, during 2006 and 2007 the maize contribution increased to 55 % on average of the total turnover as a result of better yields and prices. The income structure of the contribution of the two crops is fairly balanced, as is evident from figure 3. However, given the large fluctuations in the maize price from year to year experienced during the past decade, it is clear that variability in the maize price from season to season can be regarded as a significant risk to the income of the farm. Since South Africa is a net importer of barley, the barley price tends to remain at import parity, and therefore the barley price is not sensitive to domestic changes in the market in terms of demand or supply as is the case with maize. However, since the barley price tends to remain at import parity, this implies that the exchange rate does influence variability in the price. Thus, a big risk factor in terms of barley pricing is the exchange rate.

A comparison of barley yield versus maize yield (Figure 4) indicates that the maize yield is on average 48 % higher than the barley yield. This implies that the farm is much more sensitive in terms of income to variability and levels of maize yield than those of the barley yield. Interesting to note is that the average maize yield for this farm is 9.44 ton/ha, which is relatively low compared to other irrigation areas such as Vaalharts and the Douglas/Prieska area, where average maize yields vary between 10 ton/ha and 11.5 ton/ha. This implies that potential for increase in average maize yields does exist in the case of Taung, which could influence the profitability of the farmers positively.

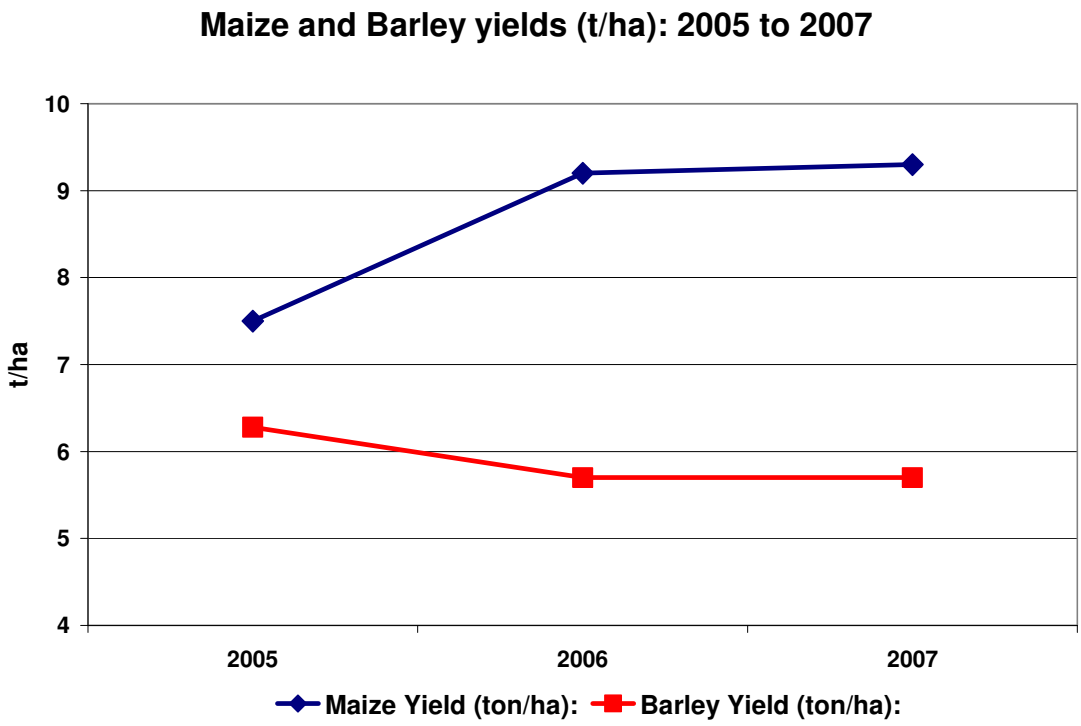

Figure 4: Maize and barley yields (2005 to 2007)

Source: SAB, 2008

In terms of the cost structure (Table 1), the fixed costs as a percentage of total costs of the farm are much lower than the norm of 25 % to 30 % for typical commercial irrigation farms. Fixed costs in this case are assumed to be minor repair and maintenance costs to the farm units themselves, and other minor diverse costs that arise from time to time. Maintenance and repairs of equipment, tools and machinery are therefore excluded from the fixed costs definition. The reason for the low fixed costs as percentage of total costs is due to the contractual arrangements of the farmers with SAB that stipulate that various contractors cultivate the fields, and the North West government supplying the land and maintaining the pivots. The fact that the fixed cost of the farm can almost be regarded as completely sunk provides the farm units with the major advantage of much greater financial flexibility, and hence improves their ability to survive and grow in adverse market conditions.

Table 1: Cost structure of total farm (*Source: SAB, 2008*)

YEAR	2005	2006	2007
Fixed costs as percentage of total costs	7 %	7 %	**7 %**
Variable costs as percentage of total costs	**93 %**	**93 %**	**93 %**

Note: Total costs excludes living costs, taxes and interest

3. Impact analyses

For the successful establishment of small scale farmers, it is imperative to have a good understanding of which exogenous factors have the largest impact on the profitability of the farm. Small scale farmers, especially small scale grain farmers producing for the commercial market, are exposed to exactly the same external drivers as their larger commercial counterparts. However, in most cases small scale farmers do not have the economies of scale benefits, so they are more sensitive to external market policy or weather related drivers/shocks.

The objective of this section is to analyse the impact of a few selected external factors that can influence the profitability of a typical small scale farm in Taung. Net Farm Income (NFI) serves as a proxy for the profitability of the farm. Net Farm Income (NFI) is calculated by subtracting production costs and the small amount of fixed costs from gross income, so interest payments, taxes and living costs are excluded from the calculation. NFI are calculated as explained due to the following reasons:

- No medium or long–term debt is present, hence no instalments or interest on medium and long-term debt is present;
- No asset replacement takes place because very few assets are owned by the farm unit,
- No data is available on living costs,
- No data on tax payments are available.

In order to analyse the impacts of the different selected external factors on farm profitability a benchmark, also referred to as a baseline, first needs to be developed. For the purpose of this brief, the baseline presents a five-year outlook of NFI (Figure 5)

subject to a range of macro-economic and policy related assumptions. This range of assumptions was directly adopted from the BFAP 2008 Baseline[2]. The baseline serves the purpose of benchmarking the impact of changes in the selected variables on NFI.

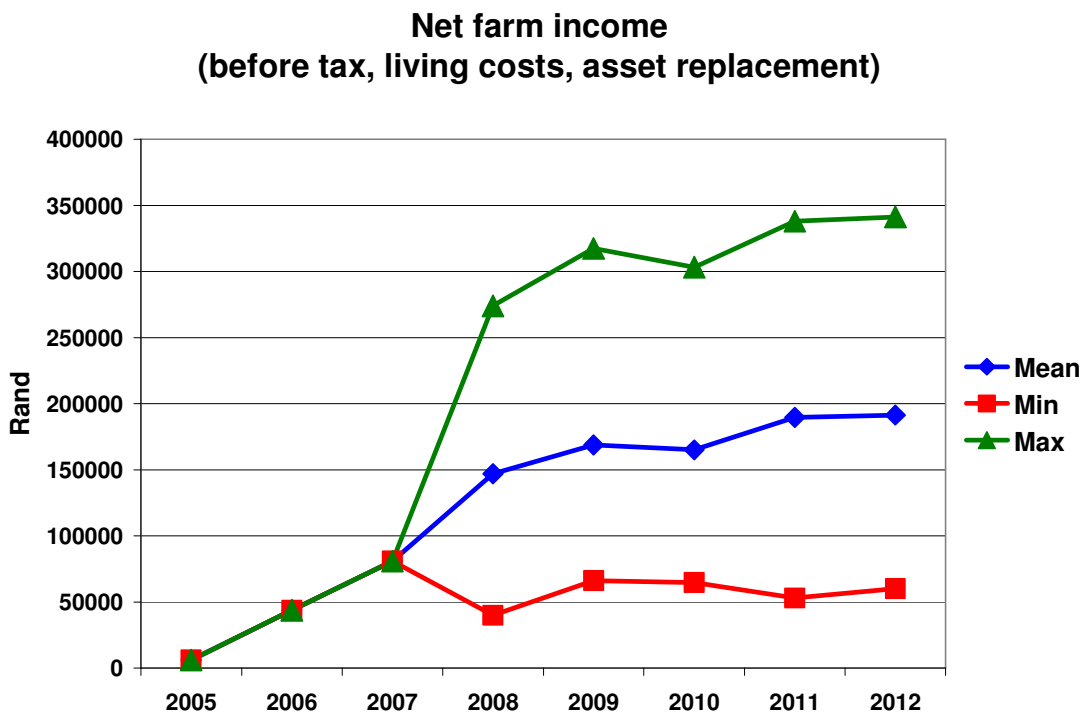

Figure 5: Net farm income projections (Baseline)

The NFI presented in Figure 5 also includes the risk of variability in yields of both maize and barley, and the variability in input and output prices of both maize and barley. In other words, in order to generate the baseline with a distribution of possible NFI values, the potential variability in the maize and barley prices, yields, and input costs needs to be taken into account. This makes it possible to generate not only an average outcome, but also a potential maximum and minimum level of Net Farm Income, given the potential variability of the various factors faced by the farmer. Thus, from Figure 5 it is clear that the potential exists for the farm to generate a NFI of R 300 000, but also that a NFI of around R 50 000 can be obtained over the next five years.

[2] To download BFAP Baseline 2008, visit www.bfap.co.za and click on the indicated icon on the homepage.

The NFI of R 300 000 is typically generated in the case where farmers obtain maximum production yields of, and extremely high sales prices for, maize and barley, and pay extremely low input prices for inputs to produce maize and barley. Profit is therefore maximised, and the farmer generates an NFI of R 300 000. In the case of generating an NFI of R 50 000, just the opposite occurs in terms of yields, sales prices and input costs. It is thus clear that the potential variability in NFI is quite large, indicating the presence of significant risk. However, on average (mean), the NFI is around R 150 000, which appears to be quite high when compared to the historical figures. This level of NFI is based on simulated conditions where the yields for both maize and barley improve over time and move closer to yields obtained by larger commercial farmers, and where output prices remain relatively high based on high international commodity prices. Should these two assumptions not hold, the simulated results of an average NFI of around R 150 000 can rightly be questioned.

An understanding of whether NFI will tend to move below the mean or stay above it calls for a careful analysis of Figure 6, which presents the probabilities of NFI being higher than R 144 000 (green area), or being between R 144 000 and R 36 000 (yellow area) for the period 2008 - 2012. From Figure 6 it can be gathered that the probability that NFI will tend to be higher than the mean is higher than the probability that NFI will be below the mean. This outlook is generated under the following assumptions:

- The quality levels of management remain constant.
- Soil potential and quality, and water quality, remain constant.
- The condition and productivity of equipment remains constant.
- The business structure and contracting structure remains unchanged, and
- Yields of both crops tend to improve over time when compared to historical yield levels.

It is important to note that, should any of the indicated assumptions change, the results will change.

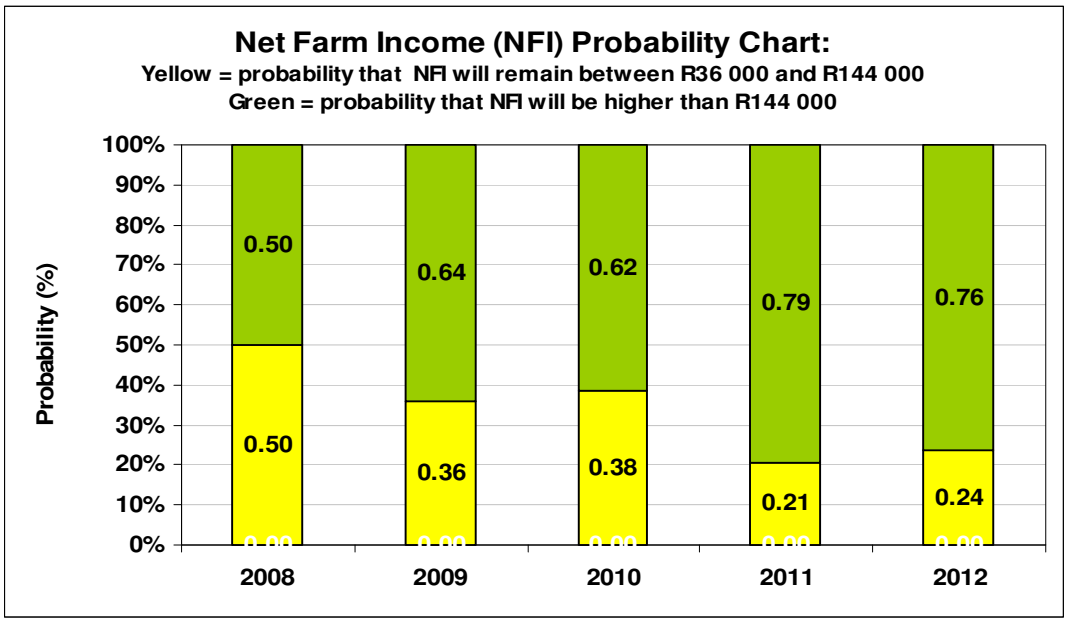

Figure 6: Net Farm Income probability chart[3]

As previously mentioned, the variability in yield and input and output prices generated the distribution of baseline NFI values, as presented in Figure 5.

In Table 2 five different scenarios are set up to analyse the potential impact and sensitivity that this farm's profitability has towards changes in external drivers that cause yields and prices to vary over time. The three external drivers identified that could have a major impact on farm profitability are the oil price, the exchange rate and the maize yield.

[3] The amounts of R 36 000 and R 144 000 were calculated in order to determine whether a family could survive or prosper. To calculate the amounts, it was assumed that the average family size is 5 persons, each needing a minimum of R 20 per day to cater for basic needs. Thus, on average, a minimum of R 36 000 is needed per annum to survive. In order to prosper, it was assumed that R 80 per day is needed per family member, hence a total of R 144 000 per annum is needed.

Table 2: Baseline and scenario assumptions

Variable	Unit	2008	2009	2010	2011	2012
Baseline: Oil	$/barrel Brent oil	99.43	112.65	94.23	104.16	**104.67**
Baseline: Exchange rate	SA cents/US $	766.99	814.06	857.60	899.51	**938.79**
Baseline: Yield	Ton/ha	9.37	9.02	9.12	9.21	**9.30**
Lower oil price scenario	$/barrel Brent oil	99.43	95.00	90.00	85.00	**80.00**
Higher oil price scenario	$/barrel Brent oil	99.43	112.65	120.00	130.00	**140.00**
Depreciating exchange rate scenario	SA cents/US $	780.00	850.00	900.00	950.00	**1000.00**
Appreciating exchange rate scenario	SA cents/US $	766.99	750.00	700.00	650.00	**600.00**
Maize yield improvement scenario	**Ton/ha**	**11.37**	**11.02**	**11.12**	**11.21**	**11.30**

Table 2 presents the five-year outlook for the baseline and five possible scenarios of the various external drivers that are introduced in the BFAP sector-level and farm-level model[4]. The impact on NFI, given the assumed changes in the various factors, is simulated by means of the two models and presented in Table 3.

[4] For more information on the BFAP models, visit www.bfap.co.za

Table 3: Average Net Farm Income under alternative scenarios

Situation	2008	2009	2010	2011	2012
Baseline	R 141 870	R 161 899	R 159 341	R 182 602	**R 183 584**
Lower oil price	R 141 870	R 161 087	R 159 043	R 180 630	**R 180 831**
Higher oil price	R 141 870	R 161 899	R 161 197	R 185 010	**R 187 892**
Depreciating exchange rate	R 133 432	R 145 944	R 147 320	R 172 252	**R 173 289**
Appreciating exchange rate	R 141 870	R 139 475	R 107 527	R 96 658	**R 70 213**
Maize yield improvement	**R 186 124**	**R 210 325**	**R 207 489**	**R 234 942**	**R 236 076**

From Table 3 it is clear that an appreciation in the Rand/US $ exchange rate has potentially the greatest negative impact on profitability. The reason for this is that although input costs decrease when the Rand appreciates, maize and barley prices decrease much more in relation to input costs, hence pressuring profits. A decrease in the oil price does have a negative impact on NFI but the impact is not significant when compared to the appreciating Rand/$ scenario.

An increase in the maize yield has the greatest positive impact on profitability, while an increase in the oil price has a much smaller positive impact. The reason why an oil price increase has a positive impact is because of the link between the maize price and the oil price due to the international production of ethanol from maize. In the case where the oil price increases, the maize price also increases. Although fuel, fertiliser and chemicals also increase as a result of the higher oil price the increase in the maize price is greater, thus causing NFI to increase.

Table 4 presents the average elasticities in terms of the relative sensitivity of NFI, with respect to a change in the selected variables. These elasticities were calculated by dividing the average percentage change in NFI (from table 3) by the average percentage change in the external factors (from table 2). For example, in the case of the maize yield improvement, the difference in NFI when comparing the scenario result to the baseline for 2009 is R 48 426 or 30 %, while the difference in maize yield for 2009, again when comparing the baseline yield assumption to the scenario yield, the assumption is 2 ton/ha or 22 %. The average elasticity is determined by calculating this percentage deviation for each of the respective years and then averaging the results and dividing them as indicated.

It is clear that NFI is most sensitive to an appreciating Rand/$ exchange rate and least sensitive to a lower oil price. The elasticity of -1.49 for a depreciating exchange rate indicates that for every 1 % that the Rand depreciates against the US $, NFI decreases by 1.49 %. An elasticity of 1.72 for an appreciating exchange rate indicates that for every 1 % that the Rand appreciates against the $, NFI decreases by 1.72 % on average.

Table 4: Average elasticity of Net Farm Income

Variable	Elasticity
Lower oil price	**0.05**
Higher oil price	**0.06**
Depreciating exchange rate	**-1.49**
Appreciating exchange rate	**1.72**
Maize yield improvement	**1.37**

One external driver that is within the control of the farmer is the maize yield. An increase of 1 % in the maize yield increases NFI by 1.37 % on average. This illustrates the importance of supporting the farmers by way of ensuring that their production practises are correct, and that they use the best available technology in order to improve their yields. In addition it is important that equipment is maintained, in addition to soil potential and water quality, to ensure that maize yields increase.

4. Conclusion

Once small scale farmers have been established and they are producing commercially, their profitability will be influenced by external drivers beyond their control. This brief indicates to what extent small scale irrigation farmers who form part of the Taung project are sensitive towards shifts in external drivers. The three external drivers identified are the oil price, the exchange rate, and improvements in maize yields. The modelling results indicate that small scale farmers are inelastic towards oil price movements but elastic towards exchange rate volatility and yield improvements. Basic economic principles dictate that, if yields improve, (without increasing expenses) the profitability of the farm improves. What is, however, interesting to note from the results is just how important yield improvements are. The results suggest that if yields increase by 1 %, NFI increases by 1.37 %. If small scale farmers can increase their yields by 10 % to reach the same level as their large commercial counterparts, their NFI will increase by 13.7 %.