Namibia FMD economics: five-year analytical update

27 September 2026 | Addendum to the exploratory working paper

The author's exploratory analysis does not represent the views or decisions of FAO, WOAH, the Government of Namibia or any other organisation.

Abstract and relationship to the original paper

This update extends the dashboard's aggregate economic accounting to a 60-month prolonged case and a 189-case fixed-default matrix across extent, policy, climate and horizon. The following pages of the original working paper retain their 48-month illustrative historical example. Read that example with this update; the five-year matrix is the current result for the longer horizon. No disease-spread simulation, premises-level forecast or causal policy-effect estimate is introduced.

Five-year comparison and metric boundaries

For the prolonged, neutral, 60-month case, historical EU-volume proxy receipts shortfall is N$2,145.5 million under each option because the assumed market-access trajectory is held equal. This is gross commercial revenue exposure after the specified diversion and deferral assumptions, not profit or social welfare. The narrow assumed cost ledger is distinct from the annual partial-equilibrium welfare result. Transfers are zero in this ledger; the absence of a measured transfer does not establish that none occurs in practice.

Policy	Receipts shortfall N$m	Public cash and real costs N$m	Profit
Stamping out	2,145.5	10.5	Unestimated
Limited vaccination	2,145.5	27.6	Unestimated
Broader vaccination	2,145.5	96.1	Unestimated

Policy ranking is conditional. A defensible comparison needs evidence that one option changes reopening time, plus a commercial contribution margin and public cost validation. With equal access paths and no margin, the table compares assumed cash requirements but cannot establish a preferred policy.

Stakeholders and welfare

The separate annual partial-equilibrium illustration for the prolonged neutral case gives southern affected producer surplus –N$46.4 million, southern unaffected producer surplus –N$359.5 million, and southern consumer surplus +N$109.6 million, for partial domestic welfare –N$296.4 million. Northern producer and consumer changes are zero under the assumed disconnected market, not evidence of no real effects. The annual surplus estimate cannot be added to the five-year receipts shortfall or the public cost totals.

Cost structure and sensitivity

The dashboard reports the underlying vaccination, diagnostic, laboratory, surveillance, cold-chain and other assumed control-cost components and recalculates the ledger from selected economic inputs. Variation in reopening lag, diversion, margin, unit costs and climate can substantially change commercial exposure and budget comparisons. Climate-linked welfare is withheld where calibration does not support it. Farm LP is a one-season optimisation and DP is a deterministic 12-month illustrative choice model;

neither is a 60-month national profit forecast.

Data, reproducibility and limitations

The historical destination-volume baseline derives from Meatco Annual Report 2024/25, 2023 destination volumes. Prices, closure duration, diversion, recovery, programme uptake, unit costs and elasticities are explicitly illustrative or transferred inputs, not observed outcomes of the September 2026 event. The dashboard publishes the fixed-default 189-case JSON, source-to-result audit CSV, equations, input tables and interactive sensitivity figures. Its current result matrix, rather than the earlier illustrative example in the following paper, governs the 60-month table above. Missing national trade flows, verified cost procurement, market interfaces, contribution margins and empirically estimated policy timing prevent a national net-benefit ranking.

Sources and companion material

Meatco. Annual Report 2024/25. Source-to-result audit and 189-case fixed-default matrix: https://fmd.syntera.global/publications/namibia-fmd-economics-2026-09/ . Interactive model laboratory: https://fmd.syntera.global/namibia/#five-year . The original paper and its complete references follow this update.

Economic exposure to FMD market interruptions in Namibia

Syntera working paper | Exploratory research | 26 September 2026

The views and scenarios are the author’s exploratory research and do not represent the views or decisions of FAO, WOAH, the Government of Namibia or any other organisation.

Reading guide: sections 1–4 document the evidence; 5–8 define trade exposure; 12–16 specify PE, LP and DP illustrations; 17–21 discuss interpretation and priorities. Trade revenue and partial welfare are distinct measures and must not be summed.

Abstract

This working paper audits the evidence for an economic-impact dashboard after the reported September 2026 foot-and-mouth disease event in southern Namibia. It supplies a reproducible, monthly trade-accounting scenario for one historical Meatco beef destination. The historical series is not a current national export forecast. No new disease-spread simulation is created. New illustrative PE, LP and deterministic DP economic adaptations are presented with explicit assumptions; none is calibrated or validated as a national impact estimate. For the assumed longer interruption and European Union historical volume proxy, the illustrative 48-month premium revenue shortfall is N$657.5 million at an assumed N$90/kg, 70% affected share, 30% diversion, 10% deferral and 25% alternative-market discount. This is neither observed loss nor welfare. The separate default PE calculation yields a conditional partial domestic-welfare change of N$-291.9 million/year; the hypothetical infected-producer subgroup accounts for −N$45.8 million/year of the southern producer-surplus change. These estimates are particularly sensitive to the transferred demand elasticity and the unmeasured trade interface.

1. Introduction and policy context

FMD can disrupt livestock movement, slaughter, certification and product-specific export access. Economic exposure depends on geography, market access, alternative outlets and the time required for commercial recovery. This paper separates verified outbreak notices from assumed economic interruption, and separates the status of WOAH-recognised zones from decisions by individual importing authorities. Findings are exploratory research by the author and do not represent the views or decisions of FAO, WOAH, Namibia, Meatco or any other organisation.

2. Evidence and data review

The Ministry published a statement dated 23 September 2026; the Livestock and Livestock Products Board published veterinary notification 15/2026. WOAH lists suspension of the FMD-free zone without vaccination effective 22 September. A company account of the ministerial statement reports a Karasburg State Veterinary District farm, 11 cattle sampled, 10 positive at the Central Veterinary Laboratory; this is secondary reporting of laboratory detail and should be checked against the signed ministry document before treating the exact count as independent laboratory evidence. Serotype and verified usable vaccine inventory are not established in the audited sources. UK APHA on 25 September suspended fresh bovine, ovine and caprine meat imports from NA-1 while distinguishing treated meat. Reopening details for other countries remain unresolved.

3. Historical trade baseline and coverage

Meatco's Annual Report 2024/25 presents a 2023 beef-export destination table: EU 9.05, South Africa 3.18, UK 1.99 and China 1.28 million kg, totalling 15.50 million kg; it reports no US exports that year. This is a historical exporter-specific volume proxy, not Namibia national 2026 exports, and does not distinguish cuts or values. Its average SVCF beef producer price N$60.31/kg in 2024/25 is a different-year, different-transaction price and is not used as a destination export price. A user-entered premium price of N$90/kg is illustrative; no currency conversion is applied. The northern communal market, south-to-north interface, live cattle, processed products and non-beef species are outside the quantified baseline because reconciled flows and price data are not available.

4. Market-access and model adaptation

There are five non-equivalent milestones: economic containment assumption; eligibility to apply for official status restoration under the applicable WOAH Code pathway; recognition after documentary review; importing-market/product authorisation; and gradual commercial volume recovery. The dashboard collapses the uncertain first four into a user-defined closure plus extra lag, and models the fifth as a linear ramp. It does not claim that a fixed number of months satisfies legal requirements. Vaccination pathways can alter the applicable requirements; a vaccination penalty is not imposed automatically.

5. Monthly accounting equations

Let V_d denote annual historical destination volume in kg, z the illustrative share exposed, C the closure months, L additional regulatory/commercial lag, and R the linear recovery ramp. In month t, market access a_t = 0 for t <= C+L and min[1,(t-C-L)/R] afterwards. Displaced volume D_t = (V_d/12) z (1-a_t). The selected user price P gives gross premium exposure G_t = D_t P. Fractions u and f are diverted and deferred, constrained u+f <= 1; price discount δ applies to diverted volume. Unsold volume U_t = D_t(1-u-f), alternative receipts A_t = D_t u P(1-δ), deferred H_t = D_t f. Illustrative immediate/irrecoverable revenue shortfall S_t = P[U_t + D_t u δ]. Deferred receipts are excluded from S_t; inventory, storage costs and eventual realisation are not quantified. Sum monthly G_t and S_t for each horizon. These counterfactual revenue measures are neither value added nor welfare.

6. Existing PE, LP and DP assessment

The repository model/uk_fmd_pe_engine.py includes a UK partial-equilibrium trade baseline and price/quantity inputs, using config/uk_fmd_params.json, data/syntera_trade_flows_species_small.csv and UK production/price and FX files. Namibia demand and supply elasticities, separate north/south production, import and export curves, processor capacity and incidence are needed before its producer surplus, consumer surplus and net welfare equations can be adapted. legacy_pages/506_Syntera_Farm_LP_TAD.py uses SciPy linprog for UK sheep/cattle enterprise, feed, forage and labour constraints in GBP; no calibrated northern communal or southern commercial Namibia farm matrix exists. The UK lab dist/lab/engine.js contains a Bellman-style aggregate adaptation with UK transitions, while app/fmd_uk_economic_twin.py has a simplified bridge. None supports a Namibia DP policy result without reopening probabilities, herd states, rewards, farm response and locally measured coefficients. Separate illustrative Namibia PE, LP and deterministic DP adaptations are specified in Sections 12–16; monthly trade accounting remains a distinct calculation.

7. Scenario definitions and inputs

The limited case assumes closure 3 months, lag 3, ramp 6 and exposed share 35%; longer assumes 9, 6, 12 and 70%; prolonged assumes 18, 12, 18 and 100%. These are deliberately broad illustrative economic paths, not biological predictions or published Namibia estimates. Common assumptions are diversion 30%, deferral 10%, alternative price discount 25% and premium price N$90/kg. Dashboard allowed ranges:

closure 0–36 months; lag 0–24; ramp 1–36; exposed share 0–100%; diversion/deferral 0–100% each with sum at most 100%; discount 0–80%; price N$20–250/kg. All common settings are assumption inputs, not sourced estimates.

8. Results and interpretation

Table 1 reports cumulative EU-proxy outcomes at 6, 12, 18, 24, 36 and 48 months. Amounts are nominal N$ at an assumed price and are not discounted. A flat 36-to-48-month result reflects full recovery under this particular assumed path, not a forecast. Price changes scale both gross exposure and shortfall linearly. Exposure share also scales linearly. Increasing diversion reduces the unsold component, but discounted alternative sales still create a premium-to-alternative price gap; deferral removes volume from the immediate shortfall without guaranteeing later realisation.

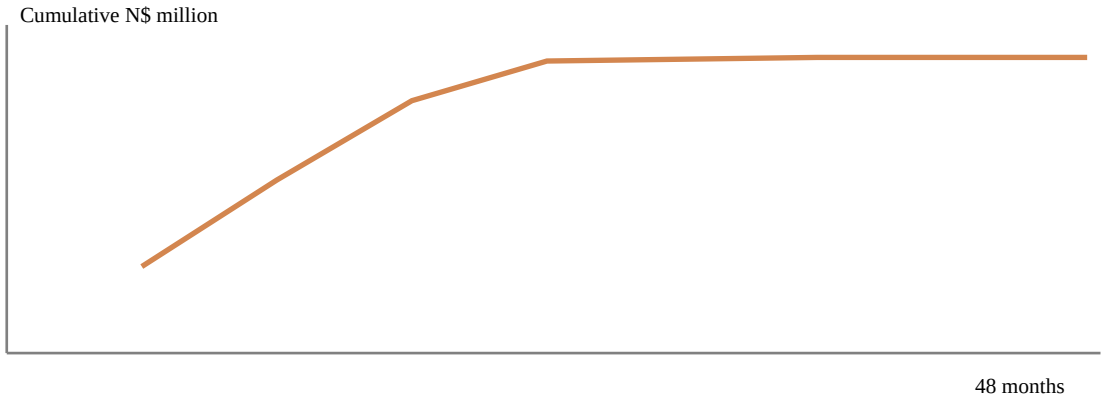


Figure 1. Default longer case, cumulative EU-proxy shortfall. Source: author calculation.

Horizon (months)	Displaced (t)	Gross N$m	Shortfall N$m	Deferred (t)
6	3,167.5	285.1	192.4	316.8
12	6,335.0	570.1	384.9	633.5
18	9,238.5	831.5	561.2	923.9
24	10,690.3	962.1	649.4	1,069.0
36	10,822.3	974.0	657.5	1,082.2
48	10,822.3	974.0	657.5	1,082.2

Table 1. Default longer case, EU historical volume proxy. Author scenario calculation; N$ assumed price.

Scenario	Closure / lag / ramp	Exposed share	48m shortfall N$m
Limited	3 / 3 / 6 months	35%	136.3
Longer	9 / 6 / 12 months	70%	657.5
Prolonged	18 / 12 / 18 months	100%	1,763.9

Table 2. Illustrative 48-month scenario comparison; not confidence bounds.

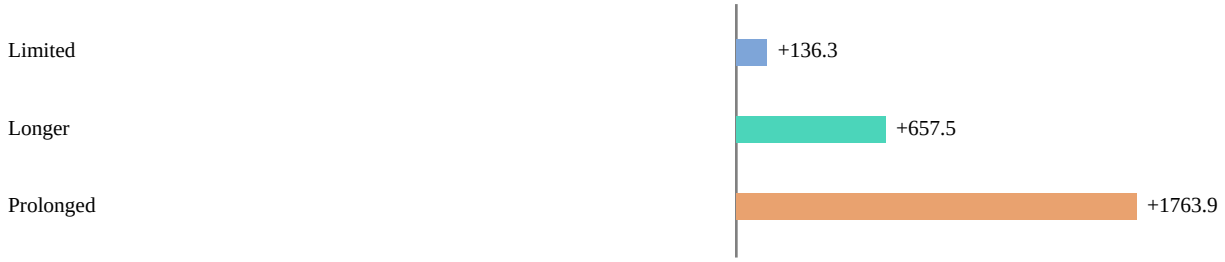


Figure 2. Conditional 48-month revenue shortfall by scenario, N$ million.

9. Distribution, sensitivity and validity

Possible adverse impacts on commercial and communal producers, processors, employees, carriers, feed suppliers, government and consumers depend on transaction prices, movement controls, input use, stock retention and market substitution. Some consumers could face higher prices even when producer prices weaken across a constrained interface. The illustrative PE extension uses assumed north/south curves to display conditional distributional results; their empirical validity remains unresolved. At 48 months in the longer case, shortfall scales from N$365.3m to N$949.7m when price alone changes N$50–130/kg; the exposed-share range 35–100% scales the N$657.5m default to N$328.7m–939.2m. These are one-parameter sensitivity intervals, not confidence bounds. A scenario comparison is more informative than treating these extremes as probabilities.

10. Costs, vaccines, laboratory, climate and limitations

Public testing and surveillance, compensation (a transfer), logistics, slaughter bottlenecks, storage, feed and water costs and household spillovers are relevant but have no validated unit-cost and quantity matrix in this audit. Vaccine-demand calculation requires verified serotype, authorised eligible product, target animals, doses, current usable stock, wastage and delivery constraints; historical delivered stock must not be counted as usable inventory. Laboratory options require observed throughput, staffing and referral turnaround. An El Niño or drought economic stress test needs independent forecast and farm feed/water baselines, with climate-only and interaction terms to prevent attributing drought effects to FMD. The exploratory dashboard calculates conditional dose requirements and climate, labour-hour and price-index sensitivities from visibly assumed coefficients; verified stock, laboratory capacity, measured employment and household impacts remain unavailable. Validation is limited to dimensional checks, volume reconciliation and deterministic sensitivity; there is no historical Namibia event validation or nationally representative baseline.

11. Discussion and next data requirements

An official destination/product status matrix, national beef-by-cut export quantities and values, northern/southern live-cattle flows, annual production and consumption, processor throughput/storage, elasticities, representative farm resource matrices, verified veterinary stock and cost records, and labour/household multipliers are prerequisites to defensible PE, LP, DP, public-budget and welfare results. Until then, the outputs are transparent scenario accounting and illustrative economic adaptations anchored to historical exporter-specific proxies. Revenue estimates must not be added to future PE welfare or public transfers without explicit reconciliation.

12. Explicit exploratory PE extension and baseline calibration

The dashboard now exposes a provisional two-market partial equilibrium exercise. Meatco 2024/25 gives south and north throughput 18.673 and 1.398 million kg and producer prices N$59 and N$37 per kg. South baseline exports use the historical 2023 Meatco total of 15.50 million kg; subtracting it from later throughput produces a constructed 3.173 million kg domestic-demand residual. This cross-year subtraction is an illustrative calibration, not observed domestic consumption. North exports are set to zero as a computational assumption because measured baseline access is missing; zero here must never be read as verified zero trade. Retail baseline prices are assumed to equal producer prices times 1.25; imports and inter-zone flows are not calibrated. Supply elasticity defaults to +0.35 without a Namibia-specific estimate; demand elasticity defaults to −0.75 as a transfer from Taljaard et al. (2003), who estimated −0.7504 for South African uncompensated beef demand. A South African retail demand estimate is not necessarily appropriate for Namibian demand. The dashboard allows −0.4 to −1.2. No local elasticity has been estimated.

13. PE equations, incidence and welfare boundary

For southern market j, supply is the sum of group curves: Qs_U=Q0(1−f)(1−c)(p/p0)^epsilon_s and Qs_I=Q0 f(1−c)(1−ell)[max(p−k,0)/p0]^epsilon_s, where f is the assumed infected-group baseline output share, ell its additional output reduction and k its assumed incremental N$/kg marginal cost. In the northern default f=0. Domestic demand is Qd_j(p)=D0_j(1−n_j)(p/p0_j)^epsilon_d; consumer price is pc_j=p_j(1+m). Export demand is an exogenous quantity X0_j−ΔX_j, with ΔX_south equal to annualised displaced EU proxy less diverted volume in the chosen horizon, and ΔX_north=0. Solve Qs=Qd+X by bisection. For each group g, variable production cost is the integral of its inverse supply: C_g(q)=p0 q[q/K_g]^(1/epsilon_s)/(1+1/epsilon_s), where K_g is that group's scale after the assumed shocks. Uninfected producer surplus is p Q_U−C_U(Q_U); the infected-group expression is (p−k) Q_I−C_I(Q_I). Subtract each group's no-shock baseline surplus; domestic consumer-surplus change equals minus the integral of domestic demand between baseline and scenario consumer prices. Thus reported partial domestic welfare is ΔPS+ΔCS. The counterfactual price wedge, export receipts accruing to processors, foreign buyer surplus, imports, government costs, and trade diversion margins are not fully represented. Consequently this is an illustrative two-market partial surplus calculation, not a calibrated national net welfare estimate. The conditional infected group is a hypothetical 10% share of baseline southern output, subject to a 5% fixed output reduction and an incremental N$3/kg marginal cost; the uninfected group retains the remaining supply curve. These are externally specified economic assumptions, not observed infected premises, prevalence or a disease trajectory. Group-specific producer surplus is calculated on each supply curve relative to its no-shock counterfactual, then summed. Northern infected share is set to zero solely for this scenario.

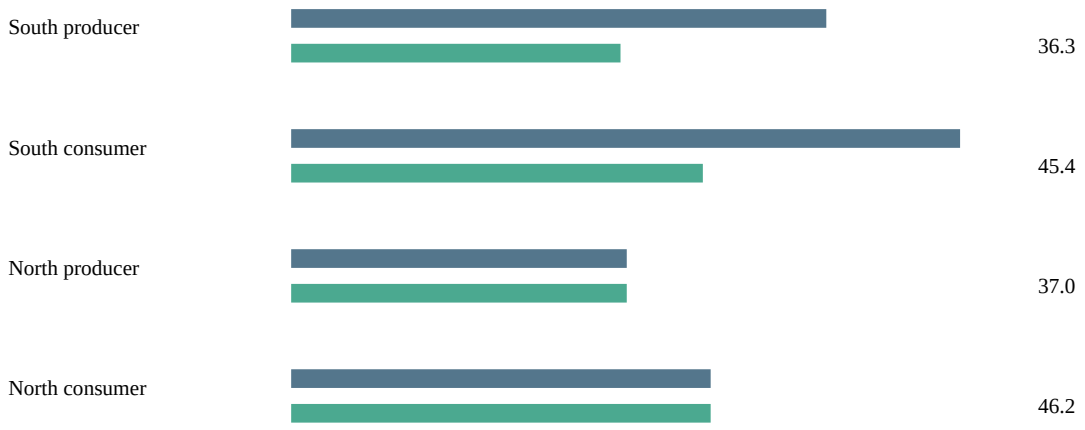


Figure 3. Grey baseline and teal scenario prices in N$/kg; retail wedge and responses are illustrative.

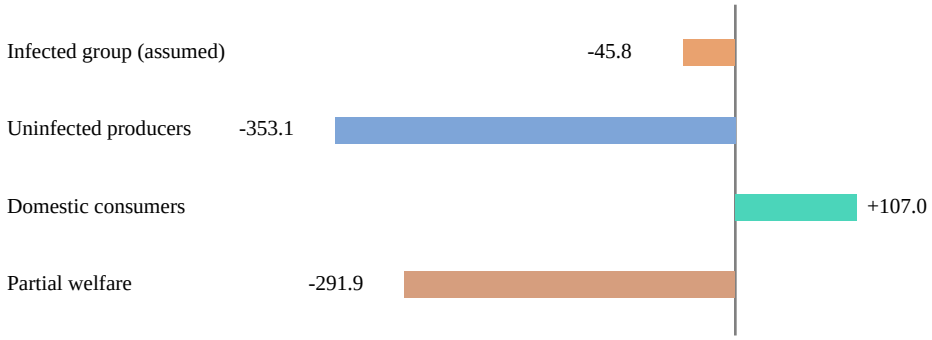


Figure 4. Conditional producer and consumer surplus changes, N$ million/year; assumed infected-group inputs.

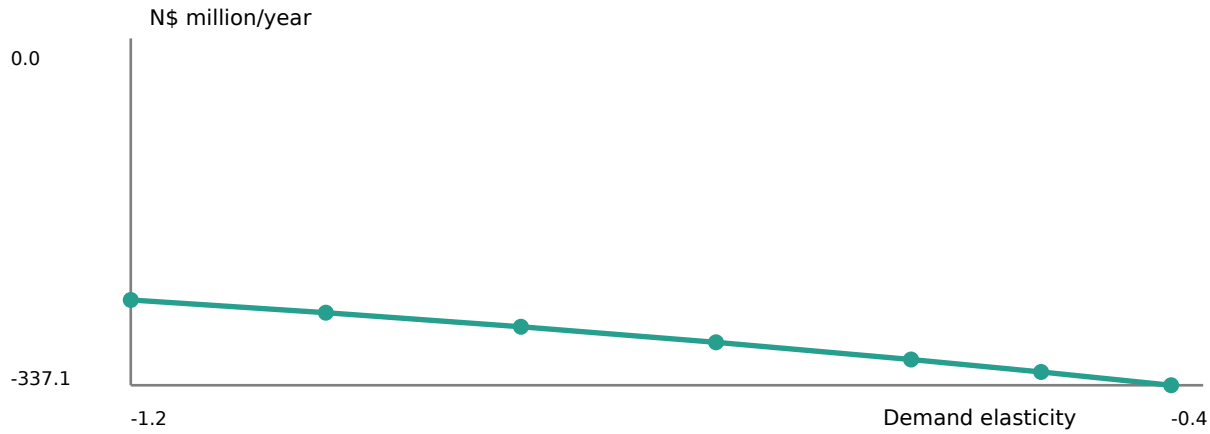


Figure 5. Partial welfare sensitivity to transferred beef-demand elasticity.

Market	Producer N$/kg	Consumer N$/kg	Output t/y	ΔPS N$m	ΔCS N$m	Partial ΔW N$m
South	36.3	45.4	15,632	-398.9	107.0	-291.9
North	37.0	46.2	1,398	0.0	0.0	0.0

Table 3. Exploratory annualised PE default; consumer and producer surplus, N$ million.

Transferred εd	South price	South ΔPS N$m	South ΔCS N$m	Two-market ΔW N$m
-0.40	32.8	-452.9	115.9	-337.1
-0.50	33.9	-436.5	113.4	-323.1
-0.60	34.9	-420.9	110.9	-310.0
-0.75	36.3	-398.9	107.0	-291.9
-0.90	37.6	-378.6	103.1	-275.5
-1.05	38.8	-360.0	99.3	-260.7
-1.20	39.8	-343.0	95.7	-247.3

Table 4. Transferred elasticity sensitivity; no Namibia elasticity estimated.

Illustrative group	Change N$m/year	Interpretation
Conditional infected group, south	-45.8	Assumed share, loss and cost; not observed cases
Uninfected groups, both markets	-353.1	Distinct supply curves
Domestic consumers	107.0	ΔCS
Processors/exporters	Unresolved	Margins unresolved
Government	Unresolved	Real costs and transfers unresolved
Partial domestic welfare	-291.9	ΔPS+ΔCS, do not add groups again

Table 6. Distribution; subgroup producer values allocate the same producer-surplus change and must not be added to total again.

14. LP objective, constraints and transfer

The one-period LP decision variables are sale head s and retained head h. Its objective is max s × [producer price × carcass weight × (1−market price discount)] + h × [terminal head value − feed cost × (1+feed inflation) − water cost × (1+climate stress)]. Constraints are s+h ≤ starting herd; s ≤ baseline channel × (1−market restriction); h ≥ minimum retained; h × per-head feed/water cost ≤ feed budget; s,h ≥0. The dashboard enumerates integer sales and chooses the optimal feasible retained level. Southern illustrative coefficients are 100 head, channel 70, retention 20, feed N$320/head, water N$90/head, terminal value N$12,500/head. Northern coefficients are 30, 15, 10, N$220, N$70 and N$5,800 respectively. Head counts, budgets, channels, feed and terminal values are assumptions. Only carcass weights (246/178 kg) and producer prices (N$59/37/kg) have Meatco provenance. This follows the resource-constraint structure of the repository UK LP, but is a new two-activity Namibia calculation, not the UK linprog run or a measured farm response. It omits herd biology, labour, price feedback and detailed feed coefficients; shadow prices are not claimed.

15. DP states, actions and Bellman recursion

The deterministic 12-month dynamic economic example has state $h_t \in \{0,...,20\}$ head; action $s_t \in \{0,...,\min(h_t, \text{accessible monthly channel})\}$ integer sales; and transition $h_{t+1}=h_t-s_t$. Its external market-access schedule has a five-month assumed closure followed by a six-month ramp, with no disease dynamics. The stage reward is $s_t \times N\$10{,}000 \times [1-0.30(1-\text{access}_t)] - (h_t-s_t) \times N\$300 \times (1+\text{climate stress})$. The Bellman equation is $V_t(h)=\max_s[r_t(h,s)+0.98\, V_{t+1}(h-s)]$, with terminal $V_{13}(h)=N\$7{,}500h$. Capacity is four head/month, scaled by assumed access. All coefficients and probabilities (there are no stochastic transitions in this example) are assumptions. The existing UK Bellman code is a structural reference; this independent Namibia-specific deterministic adaptation has no probability calibration or farm validation and should not be interpreted as the actual optimal outbreak policy.

Default LP southern illustration: sell 49 head, retain 51 head; objective N$1,324,512. DP first-month sales: 1 head; present value N$111,819. All are assumed-case outputs.

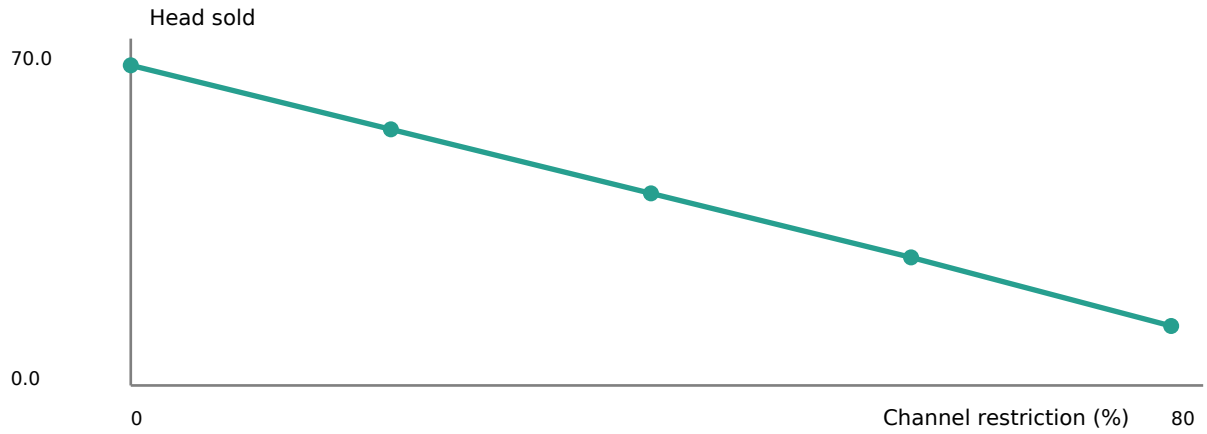


Figure 6. LP sales response to assumed market-channel restriction.

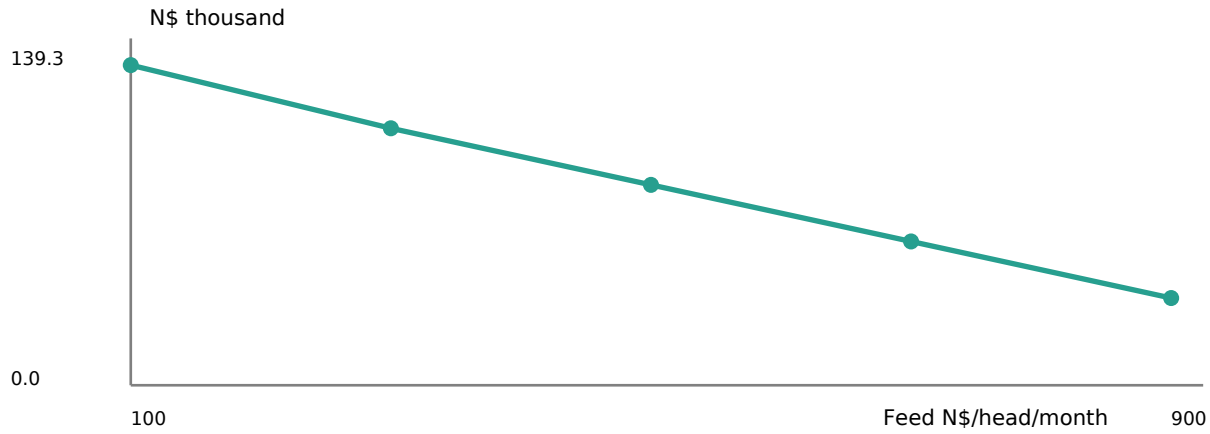


Figure 7. DP present value sensitivity to feed cost.

16. Climate, labour, food security and conditional vaccines

Neutral, moderate-dry and severe-dry cases apply assumed supply contractions of 0, 8 and 18 percent to both illustrative markets; the same stress increases LP feed/water and DP feed costs in a stylised way. They are sensitivities, not forecasts, and are compared as market-only, dry-only and combined calculations. Production-linked labour exposure is Δkg times an editable 0.025 assumed hours/kg; at N$35/hour this yields an illustrative change in wage-bill demand, not jobs lost. Food affordability is an illustrative consumer-price index with base 100 and unchanged household income; it is not food-security measurement. Vaccine doses are eligible head × coverage × rounds /(1−wastage), default illustrative 100,000 × 70% × 2 /(1−10%) = 155,556 doses after rounding. Usable stock is unknown, so procurement gap and cost remain unresolved unless the user enters a hypothetical or subsequently verified stock. Vaccine serotype, authorisation, supplier capacity and delivery times remain unresolved. These modules must not be added to the PE welfare figure.

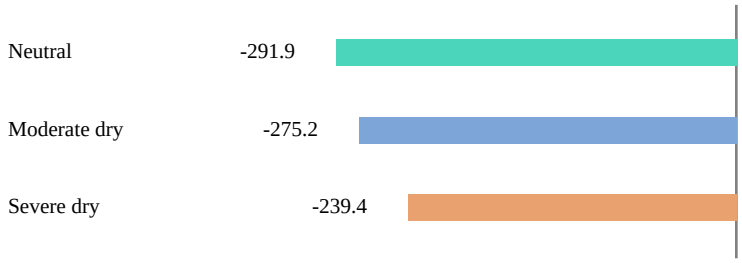


Figure 8. Combined market and dry-stress partial welfare, N$ million/year. Positive dry-only surplus values do not imply drought benefit.

Dry supply loss	Dry-only ΔW N$m	Combined ΔW N$m	South price N$/kg
0%	0.0	-291.9	36.3
8%	91.0	-275.2	42.1
18%	263.2	-239.4	52.0

Table 5. Climate-only and combined PE sensitivity; no climate forecast is inferred.

17. Interpretation of the market experiment

The reference PE experiment averages displaced export volume over the first 12 model months. This converts a dynamic trade-accounting path into one annualised export-demand shift; it is not a claim that the market stayed in a single equilibrium for the entire year. Under the default constructed baseline and fixed parameter set, southern output and its producer price fall when premium market access is reduced. Some redirected supply is absorbed by domestic demand at a lower consumer price. The resulting domestic consumer-surplus gain is smaller than the producer-surplus reduction in this example. The northern market remains at its constructed baseline when its demand shock and climate shock are zero. This zero change expresses a modelling boundary, not evidence that northern households, communal producers or processors are unaffected by restrictions. A measured interface flow or a demand linkage would be needed to estimate those channels.

17.1 Conditional infected and uninfected producer outcomes

The south supply curve is divided into two groups to make the proposed incidence calculation explicit. The conditional infected group represents an assumed 10 percent of baseline southern output. Its scenario curve is scaled by an assumed five percent output reduction and evaluated at producer price less N$3/kg of assumed added marginal cost. The remaining 90 percent follows an uninfected supply curve that responds to the same market-clearing price without the group-specific cost or output shock. Group producer-surplus changes therefore differ both because of their separate curves and because the market price is common within the southern model. The infected-group label is a conditional scenario definition only: neither the number of affected holdings, the amount they normally market nor a farm-level production loss has been established. A reader should not transform these shares into observed FMD prevalence. The subgroup surplus changes sum to the southern producer-surplus change; they must not be added again to the partial-welfare total.

17.2 What the trade and welfare measures represent

The 48-month revenue shortfall accumulates destination-specific export counterfactuals at a user-assumed premium price. The annualised PE surplus measure instead integrates prices and quantities on domestic supply and demand curves around a constructed one-year baseline. They have different time frames, coverage and economic meanings. Revenue does not remove variable input costs; the PE producer-surplus calculation does. Conversely the PE excludes foreign consumer surplus, product-specific processing margins and some public-resource costs. It would be incorrect to sum the N$657.5 million trade shortfall and the annual PE welfare change, or to identify either with national GDP loss. A full social accounting would require observed transactions and a consistent counterfactual for both domestic and international markets.

18. Sensitivity and structural uncertainty

The South African demand elasticity is a transfer, and its apparent precision should not obscure the country, time, product and retail-versus-producer differences. The demand elasticity sensitivity graph therefore plots values across a broad range rather than an interval interpreted as statistical confidence. Supply elasticity, retail margin, scenario duration, trade diversion and the assumed infected-group fraction can each change equilibrium prices and incidence. The explicit output-loss and marginal-cost controls expose a further source of uncertainty that an aggregate producer-surplus allocation would hide. Because each graph varies one or a small set of parameters while holding the remaining illustrative baseline constant, these tests reveal model mechanisms but do not produce a probability distribution of economic outcomes.

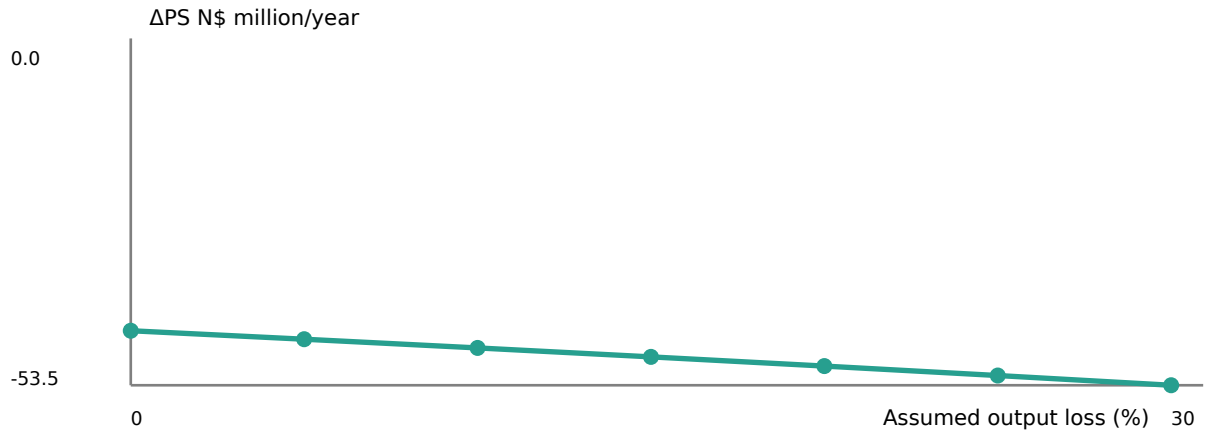


Figure 9. Conditional infected-group producer-surplus sensitivity; assumed group size and added cost held fixed.

Assumed group output loss	Infected ΔPS N$m/y	Uninfected ΔPS N$m/y	Total partial ΔW N$m/y
0%	-44.4	-357.4	-293.1
5%	-45.8	-353.1	-291.9
10%	-47.2	-348.6	-290.7
15%	-48.7	-344.1	-289.4
20%	-50.3	-339.5	-288.2
25%	-51.8	-334.8	-286.9
30%	-53.5	-330.0	-285.6

Table 7. Conditional infected-group output-loss sensitivity; no prevalence estimate is supplied.

18.1 Climate interaction and counterintuitive signs

An exogenous 8 or 18 percent supply contraction raises the scarcity of output in the PE curves. In the present fixed-export-quantity construction, this can raise the domestic producer price and even the reported partial domestic surplus while reducing physical production. That positive sign is an artefact risk of an export channel that accepts a fixed quantity at whatever domestic clearing price the model computes; it is not a finding that drought benefits Namibia or that losses are offset. The climate-only and combined bars should be interpreted as stress tests of a provisional mechanism. A defensible welfare calculation would add export demand or price limits, feed and water resource costs, imports, storage, processing constraints and household-income effects. The calculation separates the climate-only, market-only and combined cases; their difference is an interaction, not a third bill that can be added to the first two.

19. Relationship between market, farm and dynamic results

PE asks how an annualised change in export demand shifts aggregate market-clearing prices, quantities and partial surpluses. LP asks how a single stylised farm allocates current head between sales and retention under resource and channel constraints. DP asks how a stylised herd allocates sales over 12 months when market access changes on an externally specified calendar. LP and DP use different

assumed herd sizes, prices and time horizons. Their objective values are neither the net benefit of disease control nor components of national PE welfare. In particular, the LP terminal value represents an asset valuation whereas the DP terminal herd value appears in a discounted continuation calculation. They cannot be reconciled without shared farm accounts, initial stocks, seasonal production and market prices. The demonstrations are included to expose decision mechanisms and data requirements, rather than to multiply an illustrative result into a sector total.

20. Implications for data collection and decision support

The highest priority for an empirical update is a destination-by-product export series with monthly quantity, value and transaction price for the affected export zone, identifying fresh cuts, treated products and live animals separately. This would replace the cross-year subtraction and assumed N$90/kg price. A second priority is a linked northern/southern livestock balance including slaughter, domestic consumption, movements under the veterinary cordon, cold-storage stocks, processing throughput, imports and informal channels. Household demand data could then identify Namibian beef elasticities or bound them with explicit income strata. Farm accounts from southern commercial and northern communal systems could populate LP and DP enterprise margins, feed and water requirements, credit constraints and terminal herd values. Administrative cost records, vaccine serotype/authorisation and usable inventory, laboratory throughput and reference-laboratory timelines are needed before cost and procurement sections can guide budgets. Each dataset should carry geography, date, product, unit and provenance.

21. Conclusions and research recommendations

The dashboard establishes a transparent connection between source-linked outbreak evidence, historical export exposure and provisional economic model experiments while preserving important differences between them. For the longer illustrative EU-proxy case, the 48-month revenue calculation is N$657.5 million of conditional shortfall. The annualised two-market PE experiment yields a separate partial domestic-welfare result whose magnitude and distribution depend strongly on assumed curves, output-group shocks and an internally constructed baseline. Its northern zero in the neutral default is a missing-link warning, not a policy conclusion. The next research step is to replace cross-year proxy quantities and transferred elasticities with a consistent Namibian product and zone dataset, then re-estimate and validate market and farm responses. Until that is done, results should be presented as sensitivity illustrations with explicit unresolved fields, and no preferred control or vaccination policy should be inferred from their ranking.

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