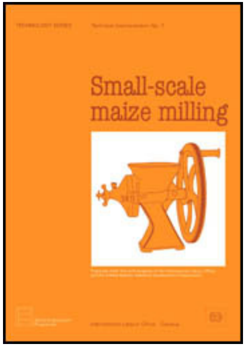

Small-Scale Maize Milling (ILO - WEP, 1984, 160 p.)

Small-Scale Maize Milling (ILO - WEP, 1984, 160 p.)

CHAPTER VI. METHODOLOGICAL FRAMEWORK FOR THE ESTIMATION OF PRODUCTION COSTS

I. INTRODUCTION

An entrepreneur wishing to invest in a maize milling plant does not generally have many choices regarding the range of scales of production. This range is, by necessity, determined by the investment funds available to the entrepreneur and market demand. Thus, these two factors determine whether he will invest in a custom mill, small-scale merchant mill, or medium to large-scale hammer or roller mill. However, within a given range of scales (e.g. small-scale merchant mills), the entrepreneur may choose among various types and capacities of mills (e.g. small-scale stone, plate or hammer mills). Furthermore, he may wish to investigate if it will be profitable to carry out various pre-milling (e.g. shelling) and/or post-milling (e.g. sifting, packaging) operations. Thus, given the adopted range of scales, the miller will need to estimate the costs and revenues associated with each alternative milling technology within this range to identify the most profitable alternative. The purpose of this chapter is to describe a relatively simple methodology for the economic evaluation of alternative maize milling technologies. This methodology applies mostly to small-scale custom and merchant mills. Entrepreneurs wishing to invest in a large-scale hammer or roller mill are advised to secure the services of a qualified engineering firm to obtain a reliable estimate of the profitability of the mill.

II. DETERMINATION OF THE SCALE OF PRODUCTION AND TYPE OF OUTPUT

The determination of the scale of production requires, as a first step, the identification of the market to be supplied. For small-scale mills, with an output of 1 to 8 tonnes per day, the potential market area may include a village or group of villages, a district or a region of the country. The region is probably the largest potential market area for mills with a capacity of 8 tonnes per day. A national market is generally associated with large-scale

mills.

Once the potential market area has been determined, the entrepreneur will need to estimate the volume of maize to be processed for this market. This estimation requires information on maize meal consumption in the market area. If this information is not available, the entrepreneur will need to undertake his own marketing study to avoid an under-utilisation of the mill's capacity in case market demand is overstated. This estimation of market demand should take into consideration other sources of supply of maize meal such as already established local mills or meal imported from outside the market area. The entrepreneur may thus estimate his potential share of the market.

Once potential demand and market share have been estimated, the would-be miller should investigate whether the required supply of maize grain will be available. This is an important consideration since many small-scale mills in developing countries have been forced to close down or operate at low capacity levels for lack of sufficient supplies of grain. The would-be miller must realise that he will be competing against other local mills and/or large-scale mills located in urban areas. Furthermore, in some countries, government legislation may favour the priority supply of maize grain to large-scale units, especially if these are publically-owned. Thus, depending on circumstances, the miller may need to adopt a lower scale of production than what is required by the estimated market demand as a result of an insufficient supply of maize.

Once the yearly output of maize meal has been determined, the miller will need to estimate the equipment capacity. The latter will be a function of the peak milling volume whenever the lack of grain storage capacity and/or market demand does not allow a constant milling capacity over the whole year. For example, a custom mill may need to process a large volume of maize in a relatively short time after the harvesting period and smaller volumes thereafter. A merchant mill, with a limited storage area, may also face similar conditions. On the other hand, a mill designed to process various types of grain

harvested at different periods of the year, may maintain a constant daily output over the year.

The would-be miller must also decide whether he will carry out various ancillary operations (e.g. shelling, sifting, packaging). His decision will be mostly a function of market demand - which determines the quality, type and marketing of meal - and of the source of raw materials (e.g. shelled or unshelled maize). The capacity of the equipment used in these operations should correspond to that of the milling equipment.

III. METHODOLOGICAL FRAMEWORK FOR THE ESTIMATION OF MILLING COSTS

Once the yearly output of meal products and the capacity of various pieces of equipment have been determined, the would-be miller will need to estimate the milling cost per unit of output for each alternative milling technique suitable for the adopted scale of production. As indicated in the previous chapters, the miller may choose among various types of shelling and milling equipment and select those which minimise production costs and best suit local conditions. For example, the choice of a diesel-powered mill may be preferable to an electric one if electricity supply is not reliable even though production costs may be lower for the latter mill than for the former one.

The estimation of production costs per unit of output must take into consideration the following items:

- **depreciation costs of equipment and buildings;**
- **maintenance and repair costs of equipment;**
- **energy costs;**
- **rental cost of land;**
- **labour costs;**
- **interest payments on working capital (in the case of merchant mills); and**
- **packaging costs (in the case of merchant mills).**

The methodology for estimating the above cost items is described below.

III.1 Depreciation costs of equipment and buildings

The yearly depreciation costs of equipment and buildings are a function of the purchase prices of the above items, the prevailing interest rate and the useful life of the individual pieces of equipment and buildings. The higher the interest rate and the shorter the useful life, the higher will be the depreciation costs. These may be readily estimated as follows:

> **Let us assume that the purchase price of a piece of equipment (Z) is 10,000 dollars, that the prevailing interest rate is 15 per cent and that the useful life of the piece of equipment is 10 years. One may then estimate the yearly depreciation cost of this equipment with the help of table VI.5 which provides the present worth of an annuity factor for various interest rates (5 per cent to 40 per cent) and various periods of time (1 year to 25 years). The table shows that the factor (F) corresponding to an interest rate of 15 per cent and a life of 10 years is equal to 5.019. The yearly depreciation cost may then be easily calculated by dividing the purchase price Z (10,000 dollars) by the factor F (5.019 in this case).[1] In this example, the yearly depreciation cost is equal to:**

$$\frac{Z}{F} = \frac{10{,}000}{5.019} = \underline{1{,}992 \text{dollars}}$$

> **[1] It may be shown that:**

$$F = \frac{(1+r)^n - 1}{r(1+r)^n}$$

In the above equation, r is the prevailing interest rate and n is the useful life of the building or equipment in years. If one wishes to obtain a more accurate estimate of the yearly depreciation cost of equipment and buildings by taking into account their salvage value at the end of their useful lives, one may use the following equation:

$$\text{Yearly depreciation cost} = \frac{Z}{F} - \frac{Sr}{(1+r)^n - 1}$$

where: Z, F, r and n are defined as above and S = salvage value of building or equipment.

The value Z of the equipment or building may be estimated as follows:

<u>Value of buildings:</u> to obtain an estimate from local construction firms on the basis of the floor plans shown in Chapter V, and the adopted type and quality of buildings. Building costs will greatly vary according to the adopted quality standard. For example, low-cost buildings may be constructed at 50 dollars or less per m^2 while high standard buildings may cost as much as 400 dollars per m^2.

<u>Value of equipment:</u> The value of equipment must include transport and insurance costs whether they are imported or bought locally. Table VI.1 provides estimates of "on-site" costs of milling equipment with outputs ranging from 25 kg per hour (vertical stone mill) to 10,000 kg per hour (roller mill). Both the f.o.b. and c.i.f. costs are provided. Table VI.2 provides estimates of "on-site" costs of maize shellers with outputs ranging from 100 kg per hour (manual sheller) to 4,000 kg per hour (motor-driven shellers).

The above estimated costs of milling and shelling equipment may be lower or higher than the costs which will apply at the time the equipment is ordered, depending on the origin of the equipment, the type of transport used, the geographical location of the country, etc. The would-be miller is therefore advised to obtain accurate quotations from local importers of equipment or foreign suppliers (see selected list of equipment manufacturers in Appendix I). The cost of locally-produced equipment may be easily obtained from local manufacturers.

The would-be miller may also need to obtain estimates of the cost of various other pieces of equipment, such as sieving equipment, grain-cleaning equipment, packaging equipment, electric generators, etc. In some cases, some of the above equipment is attached to the mill itself.

The miller may obtain an estimate of the life of milling equipment from the manufacturer. In general, the life of milling equipment may exceed 50 years if it is properly operated, maintained and repaired.

III.2 Maintenance and repair costs of equipment

Maintenance and repair costs include the cost of labour and that of spare parts. If maintenance is carried out by the miller and/or a skilled mill worker, the labour costs for maintenance may be included int the overall labour costs of the mill (see section III.5). On the other hand, if the miller must secure regular maintenance services from local fitters, he will need to obtain an estimate of the yearly cost of these services.

Table VI.1

Estimated "on-site" costs of milling equipment

Mill type	Output	Motor	Country of origin	F.O.B.	C.I.F. and

	kg/hr	kW			Inland freight
				(end 1980)	
1. Stone, vert.	25	0.5	Belgium	383	420
2. Stone, vert.	35	0.7	Belgium	401	440
3. Plate	45	0.7	United Kingdom	200	220
4. Stone, vert.	50	0.7	Belgium	466	510
5. Hammer	85	4.0	United Kingdom	2,040	2,250
6. Plate	125	2.0	United Kingdom	217	240
7. Stone, horiz.	150	3.0	France	770	850
8. Plate	150	3.5	India	900	1,000
9. Hammer	160	7.5	United Kingdom	1,826	2,000
10. Plate	180	3.5	United Kingdom	207	230
11. Hammer	180	7.5	United Kingdom	3,150	3,500
13. Stone, vert.	200	2.0	Denmark	277	300
14. Stone, vert.	240	2.0	Fed. Rep. Germany	624	690
15. Stone, horiz.	250	5.0	France	1,000	1,100
16. Plate	250	5.0	India	1,000	1,100
17. Plate	270	5.0	United Kingdom	260	290
18, Hammer	300	5.5	United Kingdom	1,124	1,250
19. Plate	300	3.0	France	205	225
20. Stone, vert.	310	3.0	Fed. Rep. Germany	654	720
21. Hammer	320	15.0	United Kingdom	3,387	3,725
22. Plate	340	5.5	United Kingdom	520	570

23. Stone, vert.	350	3.0	France	470	520
24. Stone, vert.	410	5.0	Fed. Rep. Germany	970	1,100
25. Hammer	500	5.5	Brazil	430	475
26. Hammer	570	7.5	United Kingdom	1,276	1,400
27. Stone, horiz.	600	7.5	Denmark	447	490
28. Hammer	680	30.0	United Kingdom	6,400	7,000
29. Stone, horiz.	700	9.0	Denmark	603	660
30. Stone, vert.	750	5.5	France	604	660
31. Stone, vert.	950	15.0	Denmark	683	750
32. Hammer	1,000	11.0	Brazil	750	825
33. Hammer	1,260	56.0	United Kingdom	10,400	11,450
34. Roller	2,000	110.0	United Kingdom	250,000	275,000
35. Roller	5,000	300.0	United Kingdom	400,000	440,000
36. Roller	10,000	485.0	United Kingdom	700,000	770,000

Source: **Machinery makers and authors' estimates.**

Table VI.2

Estimated "on-site" costs of maize shellers

Output kg/hr	Drive	kW	Country of origin	f.o.b. cost	c.i.f. and inland freight cost
				(mid 1981)	
100	Manual	-	United Kingdom	26	30
150	Manual	-	Fed. Rep. Germany	35	40

150	Manual	-	Fed. Rep. Germany	35	40
350	Treadle	-	Japan	243	270
500	Manual	-	United Kingdom	125	140
600	Motor	1.5	Fed. Rep. Germany	906	1,000
750	Motor	0.3	United Kingdom	174	190
1,125	Motor	1.5	Japan	580	640
1,300	Pedal	-	United Kingdom	180	200
2,500	Motor	4.5	United Kingdom	453	500
3,000	Motor	7.5	United Kingdom	2,650	3,000
2,600	Motor	5.5	Brazil	1,250	1,400
4,000	Motor	7.5	United Kingdom	2,950	3,200

Source: Machinery manufacturers and authors' estimates.

The cost of spare parts is a function of the equipment yearly utilisation rate, the quality of the grain and the care with which the equipment is maintained. As a general rule, the yearly cost of spare parts may be estimated at 10 per cent of equipment cost.

III.3 Energy costs

The milling equipment may be powered by electric motors, diesel engines or petrol engines. The yearly cost of each of the above sources of energy may be estimated as follows:

- Yearly cost of electricity

This cost may be obtained from the following relationship:

Yearly cost of electricity = (H) × (A) × (B) + C + D

where

H = estimated number of hours per year during which the equipment is functioning;
A = the rated kW of installed motor or motors;
B = the unit charge per kW
C = the yearly standing charge; and
D = other yearly charges.

It may be noted that the value of H is generally inferior to that of the total number of hours during which the mill is open since the equipment must be regularly stopped for maintenance and repairs.

- <u>Yearly cost of diesel or petrol</u>

This cost may be obtained from the following relationship:

Yearly cost of diesel or petrol = (H) × (F) × (E)

where:

H = estimated number of hours per year
F = the hourly consumption of diesel or petrol (in litres)
E = the price per litre of diesel or petrol.

The above energy costs must be estimated for each engine-powered equipment (e.g. shellers, sieves, dryers). Tables VI.1 and VI.2 provide the engine power in kW for mills and shellers of various capacities. The calculation of the engine power in hp may be obtained by multiplying the rated power in kW by 1.3410.

III.4 Rental cost of land

Whether the land is owned by the miller or not, a yearly rental cost of land must be estimated and added to the other cost items. The yearly rental cost may be estimated on the basis of the required floor area (see Chapter V) and the prevailing rental rate for land at similar locations.

III.5 Labour costs

The yearly labour costs are a function of the mill's capacity, the type of mill (e.g. custom, merchant or roller mill) and the number of sub-processes which are carried out (e.g. storage, shelling, sifting, packaging, maintenance). The operation of a small-scale custom mill may be carried out by the mill owner and, in some cases, a helper since the milling of grain is the only operation. On the other hand, a small-scale or intermediate-scale merchant mill will require a full-time or part-time manager (the mill owner in most cases), a part-time or full-time skilled worker for the operation and maintenance of the equipment (the mill owner may carry out these tasks), and a number of unskilled workers for the moving of grain and product, packaging, cleaning, etc.

The number of unskilled workers needed to move the grain and the product depends on whether the output is stored by the mill prior to despatching to clients. If such storage does take place, labour is needed for moving the grain from the trucks to the storage area and from the latter to the mill as needed. The product (i.e. the meal) must then be moved from the mill to the product storage area, and finally from the latter to the trucks. Thus, each tonne of maize (in the form of grain or product) must be moved four times. The number of unskilled workers (w) needed to perform the above tasks is then equal to:

$$w = \frac{4 \times m}{p}$$

where:

> **m = number of tonnes of maize processed per day; and**
> **p = productivity of labour, in tonnes per day.**

The value of p is a function of the local labour productivity, of the distance between the trucks and the storage area, and of the idle time between the unloading of trucks. As the above factors will vary significantly from one mill to another, no attempt will be made to provide an estimate of p. The latter must be obtained by the mill's owner on the basis of information at his disposal.

Labour may also be required for the shelling of cobs and the bagging or packing of the product. The number of unskilled workers needed for the above operations is a function of the mill's capacity. In the case of small-scale or medium-scale merchant mills, one or two operators should be able to carry out each of the above operations.

The number of unskilled workers may vary over the year, depending on whether the mill stores sufficient grain for the whole year or not. In any case, an estimation of unskilled labour requirements should take into consideration the possible closing down of the mill over a certain period of the year.

The total yearly labour and managerial costs (L) may be calculated from the following relationship:

$$L = w_u \cdot d \cdot s_u + 12 \cdot w_s \cdot S + 12 \cdot M$$

where:

> **w_u = number of unskilled workers per day for the moving of grain and product, bagging or packaging, and cleaning;**

d = number of days in the year during which unskilled labour is employed;

s_u = daily wage of unskilled labour;

w_s = number of skilled workers (assumed to be part of the permanent staff);

S = monthly salary of skilled labour;

M = monthly salary of mill owner.

The above formulation may be adapted to take into consideration the following variations:

- no moving costs of grain and product in the case of custom mills;
- no packaging costs; and
- no skilled labour costs if the work is done by the mill's owner.

The yearly salary of the mill's manager should be at least equivalent to that he would get in his next best alternative employment. The salaries and wages of skilled and unskilled labour are those prevailing in the mill's location.

III.6 Packaging costs

Maize meal may be bagged in 50 kg jute sacks or smaller sacks (e.g. 5 kg or more) depending on the local marketing conditions. The meal may also be marketed in 1 kg paper bags bearing the appropriate information (e.g. brand name, net weight, name of the mill). The jute sacks or paper bags will generally be ordered from local manufacturers. The yearly packaging costs are equal to the value of the yearly order of sacks and/or paper bags required for the packaging of the total yearly output of the mill.

III.7 Interest payments on working capital

Merchant mills may often need to store a volume of grain equivalent to three months' operation of the mill. Such storage may not be avoided given the uneven supply of maize grain over the year. Similarly, they may also need to store the produced meal and/or agree to delayed payments from clients. Thus, a volume of meal equivalent to a one month's or two months' operation of the mill may be either kept as a stock and/or sold on credit. Consequently, the miller needs some working capital to cover the cost of a volume of grain equivalent to four to five months' operations (grain in stock and grain in the form of meal) and that of labour, energy, and equipment depreciation for the processing of the stocked meal. Since this working capital may be considered idle capital, the yearly interest payments on the latter constitute a cost item to be added to the other items.

III.8 Unit production cost of meal produced by small-scale mills

The estimation of unit production cost of maize meal is the last step in the evaluation of alternative maize milling techniques. The unit production cost is equal to the sum of the yearly cost items (identified in sections III.1 to III.7) divided by the total yearly output of maize meal. The most appropriate milling technique is that associated with the lowest unit production cost. The choice of equipment and scale of production should therefore correspond to the identified lowest cost technique.

In the case of custom mills, the most appropriate milling technique will be the one associated with the lowest sum of depreciation costs (building and equipment) and energy cost per unit of output since labour inputs are the same for all techniques (i.e. the labour of the mill's owner and, in some cases, that of a helper).

In the case of merchant mills, the evaluation of alternative milling techniques should take into account market demand for various qualities of meal. For example, a miller may market either non-processed whole meal or partly sifted whole meal (i.e. partial removal of germ and bran). In the latter case, he may use a mill equipped with a sifting device. The

comparison between the production of whole meal and that of partly sifted meal should therefore take into consideration the differential cost of the equipment and the differential retail prices of the product (i.e. the price of whole meal and that of partly sifted meal) and of by-products (i.e. bran and germ). In this case, the choice of technology involves both a choice of milling technique and a choice of product.

III.9 Unit production cost of meal produced by roller mills

The cost structure of roller mills is much more complex than that of small-scale mills. Since this memorandum is mostly concerned with these latter mills, no attempt will be made to describe in detail the cost structure of roller mills.

The principal cost items for a roller mill are those of raw maize, packing, labour, storage of raw materials and products, management and administration, transport, insurance and taxes. Other important cost determinants are location, working capital tied up in raw maize storage, capacity utilisation and length of operating season. According to Uhlig and Bhat (1980), raw maize accounts for "more than 80 per cent of total net present costs discounted at 10 per cent" on the basis of Kenyan factor prices. This figure provides a very convenient, if rough guide to the estimation of unit costs. One only needs to know the local price of raw maize in order to estimate unit production costs. If a more accurate guide is needed (e.g. in cases where estimated unit costs are close to retail prices), more detailed information is needed on the quantity and price of the factors of production.

The cost of packing materials ranks second in magnitude to raw maize costs. It represents 6 to 9 per cent of the total unit cost depending on whether the packing of meal is done manually or mechanically. Packing costs can be lowered by a small percentage if larger bags or sacks are used (e.g. use of 50 kg sacks instead of 25 kg sacks).

Labour and management costs rank third at under 5 per cent of unit costs, reaching 2 per cent in machine-intensive plants. The management proportion of this cost element is high,

approximately 48 per cent of total labour and management costs for the smallest scale roller mills (2 tonnes/hour). This proportion decreases as the scale of production increases, but does not generally go below 32 per cent.

Other cost items for roller mills are far less significant than the three cost items indicated above. Insurance, administration and maintenance costs represent approximately 4 per cent of total unit costs.

IV. ILLUSTRATIVE EXAMPLES OF THE ESTIMATION PROCEDURE

The estimation procedure described in section III may be illustrated with respect to two types of mills: a custom mill with an output of 1 tonne per day and a small-scale merchant mill with an output of 8 tonnes per day. The custom mill uses an electric plate mill equipped with a 2 kW motor (mill No. 6 in table VI.1), while the merchant mill uses an electric hammer mill equipped with an 11 kW motor (mill No. 32 in table VI.1). Both mills produce whole meal.

Table VI.3 provides the various yearly cost items estimated on the basis of the following assumptions:

(i) <u>Custom mill</u> (rural area)

- **Output: 1 tonne per day;**
- **Organisation of production: 8 hours per day, 300 days per year;**
- **Price of maize: US$150 per tonne of grain;**
- **Price of plate mill (on-site): US$500;**
- **Cost of building: US$300;**
- **Labour: Mill's owner and assistant;**
- **Energy cost: US$0.1 per kWh;**
- **Energy consumption: 2,400 kWh per year;**

- Spare parts: US$50 per year (10 per cent of equipment cost);
- Land rental: US$300 per year;
- Life of building and equipment: 25 years;
- Interest rate: 15 per cent;
- Working capital: none;
- Mill's yearly profits: US$5,000; and
- Monthly salary of assistant: US$150.

(ii) Merchant mill (urban area)

- Output: 8 tonnes per day;
- Organisation of production: 8 hours per day; 300 days per year;
- Price of maize: US$150 per tonne of grain;
- Price of hammer mill: US$1,200;
- Cost of buildings: US$4,000;
- Labour: Mill's owner plus four unskilled workers;
- Energy costs: US$0.1 per kWh;
- Energy consumption: 26,400 kWh per year;
- Spare parts: US$120 per year;
- Land rental: US$1,200 per year;
- Life of buildings and equipment: 25 years;
- Interest rate: 15 per cent;
- Working capital: Volume of maize grain equivalent to one or three months of mill's operation (200 tonnes or 600 tonnes);
- Mill's yearly profits: US$12,000; and
- Monthly salary of unskilled labour: US$200.

It is assumed that the maintenance of both mills is carried out by the mill's owner. Bagging or packaging costs are not considered in this example in order to facilitate the

comparison between the two types of mills. However, it is most probable that the merchant mill will need to add a packaging cost to the other cost items.

Table VI.4 provides estimates of unit production costs for both mills as well as a minimum wholesale price of maize meal. It may be seen that, in this particular example, the unit production cost for the merchant mill is significantly lower than that for the custom mill even though the merchant mill must keep a stock of grain in order to avoid temporary shutdowns of the mill. In case the merchant mill does not need to maintain a stock of grain, the unit production cost will be US$11 per tonne instead of US$13 or US$17. It may also be noted that unit production costs vary between 7.98 per cent and 14.30 per cent of the wholesale price. These fractions are significantly lower than the approximately 20 per cent which applies to large-scale roller mills. However, one should not compare roller mills with small-scale custom or merchant mills since the type of output produced by the latter is different from that produced by roller mills.

Table VI.3

Yearly costs of a custom mill and of a merchant mill

	in US$	
	Custom mill	**Merchant mill**
Labour costs	1,800	9,600
Profits	5,000	12,000
Equipment and building depreciation costs[1]	124	805
Energy costs	240	2,640
Spare parts	50	120
Land rental costs	300	1,200

Interest on working capital[2]	-	4,500; 13,500
Total yearly costs[2]	7,514	30,865; 39,865

[1] Factor F is equal to 6.464 (see table VI.5);

[2] Estimated on the basis of one month's stock and three months stocks of grain (merchant mill only).

Table VI.4

Unit production costs of a custom mill and of a merchant mill

	Custom mill	Merchant mill
Total yearly costs[2] (US$)	7,514	30,865; 39,865
Total yearly output (tonnes)	300	2,400
Unit production cost[2] (US$ per tonne)	25	13; 17
Minimum wholesale price of meal[2] (US$ per tonne)	175	163; 167
Production cost as a percentage of wholesale price (per cent)	14.30	7.98; 10.18

[2] Estimated on the basis of one month's stock and three months stocks of grain (merchant mill only).

This illustrative example should not lead to the conclusion that unit production costs are lower for merchant mills than for custom mills. The example is based on too many assumptions which may not apply in a large number of cases. It is therefore essential that the would-be miller undertakes his own evaluation, based on accurate estimates of the

various cost items, with a view to identifying the milling technique which is the most suitable to prevailing local conditions.

Table VI.5

Present worth of an annuity factor
How much 1 received or paid annually for X years is worth today

Year	5%	6%	8%	10%	12%	14%	15%	16%	18%	20%	22%	24%	25%	26%	28%
1	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862	0.847	0.833	0.820	0.806	0.800	0.794	0.78
2	1.859	1.833	1.783	1.736	1.690	1.647	1.626	1.605	1.566	1.528	1.492	1.457	1.440	1.424	1.39
3	2.723	2.673	2.577	2.487	2.402	2.322	2.283	2.246	2.174	2.106	2.042	1.981	1.952	1.923	1.86
4	3.546	3.465	3.312	3.170	3.037	2.914	2.855	2.798	2.690	2.589	2.494	2.404	2.362	2.320	2.24
5	4.330	4.212	3.993	3.791	3.605	3.433	3.352	3.274	3.127	2.991	2.864	2.745	2.689	2.635	2.53
6	5.076	4.917	4.623	4.355	4.111	3.889	3.784	3.685	3.498	3.326	3.167	3.020	2.951	2.885	2.75
7	5.786	5.582	5.206	4.868	4.564	4.288	4.160	4.039	3.812	3.605	3.416	3.242	3.161	3.083	2.93
8	6.463	6.210	5.747	5.335	4.968	4.639	4.487	4.344	4.078	3.837	3.619	3.421	3.329	3.241	3.07
9	7.108	6.802	6.247	5.759	5.328	4.946	4.772	4.607	4.303	4.031	3.786	3.566	3.463	3.366	3.18
10	7.722	7.360	6.710	6.145	5.650	5.216	5.019	4.833	4.494	4.192	3.923	3.682	3.571	3.465	3.26
11	8.306	7.887	7.139	6.495	5.938	5.453	5.234	5.029	4.656	4.327	4.035	3.776	3.656	3.544	3.33
12	8.863	8.384	7.536	6.814	6.194	5.660	5.421	5.197	4.793	4.439	4.127	3.851	3.725	3.606	3.38
13	9.394	8.853	7.904	7.103	6.424	5.842	5.583	5.342	4.910	4.533	4.203	3.912	3.780	3.656	3.42
14	9.899	9.295	8.244	7.367	6.628	6.002	5.724	5.468	5.008	4.611	4.265	3.962	3.824	3.695	3.45
15	10.380	9.712	8.559	7.606	6.811	6.142	5.847	5.575	5.092	4.675	4.315	4.001	3.859	3.726	3.48
16	10.838	10.106	8.851	7.824	6.974	6.265	5.954	5.669	5.162	4.730	4.357	4.033	3.887	3.751	3.50

17	11.274	10.477	9.122	8.022	7.120	6.373	6.047	5.749	5.222	4.775	4.391	4.059	3.910	3.771	3.51
18	11.690	10.828	9.372	8.201	7.250	6.467	6.128	5.818	5.273	4.812	4.419	4.080	3.928	3.786	3.52
19	12.085	11.158	9.604	8.365	7.366	6.550	6.198	5.877	5.316	4.844	4.442	4.097	3.942	3.799	3.53
20	12.462	11.470	9.818	8.514	7.469	6.623	6.259	5.929	5.353	4.870	4.460	4.110	3.954	3.808	3.54
21	12.821	11.764	10.017	8.649	7.562	6.687	6.312	5.973	5.384	4.891	4.476	4.121	3.963	3.816	3.55
22	13.163	12.042	10.201	8.772	7.645	6.743	6.359	6.011	5.410	4.909	4.488	4.130	3.970	3.822	3.55
23	13.489	12.303	10.371	8.883	7.718	6.792	6.399	6.044	5.432	4.925	4.499	4.137	3.976	3.827	3.55
24	13.799	12.550	10.529	8.985	7.784	6.835	6.434	6.073	5.451	4.937	4.507	4.143	3.981	3.831	3.56
25	14.094	12.783	10.675	9.077	7.843	6.873	6.464	6.097	5.467	4.948	4.514	4.147	3.985	3.834	3.56