AN ANALYSIS OF SOME FACTORS AFFECTING PRICE
DIFFERENTIALS BETWEEN LARGE, MEDIUM,
AND SMALL GRADE A EGGS IN CANADA

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This study is an analysis of some factors affecting price differentials between large, medium, and small Grade A eggs. In economic theory, price differentials between the sizes of A grade eggs are justified on the basis of differences in form utility. The basic assumption of this study is that large, medium, and small A grade eggs are regarded as perfect substitutes for each other by the final consumer.

The objectives of the study are to analyse and delineate the nature and extent of the economic problem of price differentials for A grade eggs in Manitoba. Second, to analyse the differences in form of A grade eggs. The next objective is the formulation of the theoretical model of the perfect market in order to determine appropriate price differentials and to measure aberrations in prices. Other objectives of the study are to describe and analyse the price differentials for A grade eggs and to account for divergences from the theoretical standard.

The problem of the study revolves around the efficiency

of the marketing system in performing its function whereby
prices adequately reflect differences in grade attributes
between large, medium, and small A grade eggs in Manitoba.
The hypothesis is put forward that relative to the prices
of A-large eggs the prices of A-small and of A-medium eggs
do not adequately reflect their grade attributes.

Contrary to expectations, the prices of A-small eggs
and of A-medium eggs are not a constant proportion of the
prices of A-large eggs. Given homogeneity of quality, size
or food content is, therefore, not the only important
consideration in the purchase of eggs. Buyers have a
tendency to pay more for A-small, but especially for A-medium,
when the supply of A-small and of A-medium eggs are short
relative to the supply of A-large eggs.

The price differentials between large, medium, and
small A grade eggs have been increasing at both retail and
producer levels in Manitoba. On the basis of increasing
price differentials at the retail level, it is fair to con-
clude that buyers are either unaware of the magnitude of
the differences between the three sizes of A grade eggs,
or that they are becoming more irrational in their
purchases of eggs.

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CHAPTER I

INTRODUCTION

A great deal of study and research has gone into the matter of an equitable and practical basis for selling eggs in Canada. The value of a quality product always has been apparent. As a result there developed in Canada three main grades of eggs "A", "B", and "C".

The Canadian consumer has been educated through the medium of the high standard federal egg grading regulations to demand eggs of Grade A quality only for consumption. Market requirements have become more stringent as consumers have become more conscious of egg quality. "Stale eggs kill the demand for eggs more than high prices do."[1] "Quality is at its best in fresh laid eggs because at that time they have their greatest nutritive value as an article of human food."[2] From the time that eggs are laid until the time they are consumed they are often subjected to a variety of conditions which result in marked deterioration in quality.

The poultry industry is in an extremely dynamic state.

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[1]Jull, M. A., Poultry Husbandry, Mc Graw Hill Book Company, New York, 1951, p. 398.

[2]Jull, op. cit., p. 390.

Commercial poultry production with its opportunities for more efficient management, improved feeding, better breeding and more effective sanitation has changed the status of the poultry industry both on and off the farm. On the farm the poultry enterprise has become and still is becoming less and less a side line activity. "In the mixed farming areas of Saskatchewan, the only farmers who were able to make a reasonably good showing on their last year's business (1958) were those with a good flock of laying birds - generally three to five hundred birds."[3] There has developed, too, a group of commercial egg producers with substantially large flocks - over five thousand birds - who have become increasingly aware of the new emphasis placed on marketing and who are endeavouring to respond to consumer preferences by providing eggs of high quality at all times.

> ... Statistics on eggs marketed through registered egg grading stations have been collected by the Department of Agriculture since 1943 and even in this short period marked changes are to be noted. The marketing pattern of ten years ago has only one feature in common with the current pattern; namely marketings are usually heaviest in April and May. In almost every other respect the pattern has changed..[4]

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[3]Payne, F. E., "The Farm Flock will survive at Three Levels", Canada Poultryman, April 1959.

[4]"Seasonal Egg Marketing Pattern", Poultry Products Market Report, December 4, 1953.

It is becoming evident that there is less need for storage eggs to fill the gap between domestic disappearance and supplies of fresh eggs during the seasonal decline in production and that supplies of fresh shell eggs are capable of meeting market requirements twelve months of the year.

II. OBJECTIVES

The main objectives of research in agricultural marketing are the maximum satisfaction of consumer demands through the development and maintenance of pricing systems that accurately reflect those demands, to provide additional knowledge for predictive purpose and to improve the efficiency of the marketing system so that resources are properly allocated.

The objectives of this study are to analyse and delineate the nature and extent of the economic problem of price differentials for Grade A eggs in Manitoba. Second, to analyse the differences in form of Grade A eggs. This involves outlining the theory and objectives of a grading system, an examination of Canadian grade specifications and discussing variations in egg quality.

The next objective is the formulation of the theoretical model of the perfect market which is used as the standard from which aberrations in prices are measured and to determine appropriate price differentials for Grade A eggs.

Other objectives of the study are to describe and analyse

the price differentials for Grade A eggs and to account

for divergences from the theoretical standard.

III. THE PROBLEM

An important motivational force in the selection of a

problem for economic research is the lack of knowledge or

"vague intellectual discomfort" about economic phenomena

which tend to indicate imperfections in the efficiency of the

marketing system in performing its functions and discrepancies

between observed occurrences and the generally accepted

explanation. A problem is essentially that aspect of a

situation which if modified will correct the difficulty.

In short, the problem is the limiting factor in the

reconstruction of the situation.[5] The problem of this study

revolves around the efficiency of the marketing system in

performing its function whereby prices adequately reflect

differences in grade attributes between large, medium and

small Grade A eggs in Manitoba.

The problem of the marketing system adequately

reflecting grade price differentials for large, medium and

small Grade A eggs is essentially a normative one, since,

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[5]Parsons, K. H., "The Logical Foundations of Economic
Research", Journal of Farm Economics, Vol. 31, No. 4,
November, 1949, p. 663.

in the course of the analysis, it is necessary to set up in theory a standard with which the actual differentials are compared. It is a common practice for the economist to attempt to treat problems as the discrepancy between the actual situation and some ideal assumed to be the relevant solution. The implication is that the problem is normative and the solution is simply a priori and arbitrary without regard to available alternatives in the situation.[6] The solution to the problem of grade price differentials for eggs is not a priori and arbitrary as recourse is made to actual data and conclusions subjected to empirical verification.

An analysis of the problem leads naturally to the formulation of the hypothesis that the price received for a given commodity - in this case A-medium or A-small eggs - at a specified time and place does not always reflect its grade attributes. The hypothesis is put forward that A-medium eggs tend to be over-valued relative to A-large eggs, whereas A-small eggs tend to be under-valued relative to A-large eggs at the producer level of the marketing system.

IV. IMPORTANCE OF THE PROBLEM

The economic importance of the problem is best

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[6]Parsons, loc. cit.

illustrated by looking at farm cash income from sales of eggs.
For Canada farm cash income from the sales of eggs amounted to
$143 million and $149 million in 1957 and 1956 respectively.
For Manitoba farm cash income from the sale of eggs amounted to
$10 million in both 1956 and 1957. Cash income from eggs repres-
ented approximately 5 per cent in 1957 and approximately 4.7 per
cent in 1956 of the total farm income in Manitoba.[7]

Price differentials between A-medium and A-large average
about 3 cents per dozen and between A-small and A-large approx-
imately 12 cents per dozen at the producer level. In 1957
approximately 3 million dozen A-medium eggs and approximately
712 thousand dozen A-small eggs were marketed in Manitoba. On
the basis of average price differentials and A-large eggs
priced at 30 cents per dozen the marketing of A-medium
eggs in 1957 returned approximately 16 thousand dollars more
and of A-small approximately 35 thousand dollars less than
the marketing of identical quantities of food content of
A-large eggs to Manitoba egg producers.

V. SCOPE OF THE STUDY

This study is not designed to examine the accuracy

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[7]Figures taken from Poultry Products Market Report,
Canada Department of Agriculture, June 5, 1959.

and adequacy of the grade standards, but to direct attention
to some of the economic effects of the use of official
standard grades under present conditions of production,
processing and distribution of eggs in Manitoba. In,
brief, the study is an analysis of some of the factors
affecting price differentials between large, medium, amd
small Grade A eggs at the producer level in the marketing
system.

A-large eggs, both in terms of prices and quantities
are used as the basis for all comparisons with the other
compulsory grade A-medium and the optional grade A-small
used in the study. All marketing data and market statistics
used in this study are for the period 1952 to 1957 inclusive,
a sum total of six years.

Instead of an examination of all grades of eggs, the
study on price differentials is confined to Grade A eggs
only. One of the reasons for delimiting the study to eggs
of Grade A quality is that Canadian consumers generally
demand Grade A eggs only for consumption purpose, while
the demand for the lower grades, "B", "C" and Cracks is
derived from the demand for frozen eggs or melange used in
the manufacture of ice cream, mayonnaise, prepared foods
like noodle soups, and in the bakery trade.

A more important reason for confining the study to
eggs of Grade A quality is to eliminate the need to measure

quantitatively differences in quality between the various grades of shell eggs. It is almost impossible to measure interpersonal satisfaction. Therefore, without this measure, the task of developing objective weights for quality factors to measure quantitatively quality differences in eggs is made even more formidable. In order to avoid the obstacle of developing quantitative measures of quality, and for the sake of greater manageability the study is limited to shell eggs of Grade A quality.

The price series used are prices paid to producers at registered grading stations in Winnipeg. In a study of price differentials, the major concern is with the relationship between prices rather than absolute levels of prices. So long as the relationships exist to the same degree and in the same direction it is a matter of indifference which point price is selected. In the analysis of price differentials for large, medium and small Grade A eggs, at the producer level in the marketing system, reference has to be made to retail prices and retail differentials as the demand at the producer level is derived from consumer demand as reflected by retail price and quantity relationships.

On the supply side the data used are receipts of shell eggs at registered grading stations in Manitoba. The proportion of all eggs produced in Manitoba that passes through registered grading stations is generally estimated

at approximately 48 per cent. For Canada the proportion
passing through registered grading stations is estimated at
around 45 per cent.[8] The fact that the supply data represent
only 48 per cent of the population does not seriously affect
the analysis as long as the grade distribution pattern
remains fairly stable over time. Reference to Table I shows
a fairly constant grade distribution pattern from 1952 to
1957.

The first section of the analysis deals with the
differences in form of Grade A eggs. In this section the
theory and objectives of a standardized grading system and
the grade specifications for A-grade eggs are outlined.
Mention is made of some of the variations that exist in
measuring interior quality of shell eggs by the accepted
method of hand candling. Differences in the form of Grade A
eggs are then discussed. The chapter which follows treats
the theory and methodology. The standard from which
aberrations in price relationships are measured is provided
by the abstract concept of the perfect market, especially
with respect to form. The applicability of the statistical
measures and techniques used is also discussed. Next the
grade price differentials are examined, described and
compared to the theoretical standard in the perfect market.

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[8]Estimates taken from Poultry Products Market Report,
Canada Department of Agriculture, October 24, 1958.

The factors which influence the price differentials are analysed. The final chapter contains the summary and conclusions drawn from the study. It is well to note that in a study of this type the conclusions drawn must be broad and general in nature.

TABLE I

DISTRIBUTION BY GRADE AS A PERCENTAGE OF TOTAL
RECEIPTS AT REGISTERED GRADING STATIONS
MANITOBA, 1952-1957*

YEAR	A-LARGE	A-MEDIUM	A-SMALL
1952	46.9	18.2	3.2
1953	45.2	17.4	3.0
1954	47.8	18.4	3.1
1955	46.9	18.3	3.5
1956	46.5	19.3	4.5
1957	48.1	19.8	4.6

*Source: Poultry Products Market Revidw, 1952-1957.

A-medium to A-large producer price ratios, A-medium to A-large retail price ratios, and A-small to A-large price or quantity ratios are rather long phrases to be repeated over and over throughout this study. To avoid tedious repetition, frequent resort is made to abbreviations. A-large is abbreviated to AL, A-medium to AM, and A-small to AS.

CHAPTER II

ANALYSIS OF THE DIFFERENCES IN FORM OF GRADE A EGGS

Form encompasses both quality and quantity characteristics. Before any analysis is carried out it is necessary to outline the differences in form of Grade A eggs, the objectives and theory of a standardized grading system and the variations that exist in egg quality.

I. THEORY AND OBJECTIVES OF A STANDARDIZED GRADING SYSTEM[1]

Grading is the sorting of products into lots, each of which has substantially homogeneous quality characteristics.[2] The economic effects of an institutional system of grades and grading are reflected by the policies, decisions and actions of the firms operating in the market. Grading is an important service in marketing which should be rendered if and when the net effects are beneficial. Despite some imperfections, the grading system has tended to increase the accuracy, ease, and effectiveness of prices in reflecting value differences for eggs at each stage in the marketing system, by assisting consumers in the expression of their

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[1]The ideas on the theory and objectives of grading are drawn from Thomsen, F. L., Agricultural Marketing, McGraw Hill Book Company, New York, 1951, Chap. 13.

[2]Thomsen, op. cit., p. 262.

preferences; improving to some extent the degree of precision
by which preferences of consumers are transmitted through the
marketing system to the producers.

Standardization is defined as making uniform among
buyers and sellers, and from place to place and time to time,
the quality specifications of grades.[3] Without standardization
the effectiveness of grading is wholly or partially reduced as
grade specifications become variable. In economic analysis,
the sole reason for grade standards in marketing is the
existence of value or price differentials arising out of
differences in the economic utility of products of varying
quality and / or, quantity characteristics.

Grade specifications are not to be considered as merely
descriptive of physical characteristics of the commodity
without any regard to the market evaluation of those
characteristics. One grade of a commodity, no matter how it
is differentiated, will not sell for a cent more than any
other in the market if in the minds of prospective buyers
there are no advantages, in terms of utility, to be derived.
If quality differences do not result in a price differential,
or affect marketing costs, neither buyers or sellers will go
to the trouble and expense of grading or buying by grade.
For any system of grades to be workable and practical, buyers

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[3]Thomsen, op. cit., p. 267.

must be reasonably homogeneous with respect to the relative importance of the different quality factors taken into account in the grade specifications.

Theoretically, there are several advantages of grading. To be more precise there are several main objectives of a standardized system of grades. These objectives may be conveniently listed under the term pricing efficiency which embodies the price discovering role of the market system.[4] It involves the extent to which, in terms of speed, accuracy, effectiveness and lack of controls, the marketing system discovers prices which measure final consumer product values and reflects these values through the various stages of the marketing system back to producers. The principal objectives of a standardized system of grades are to:

(1) Provide a framework by which consumers are assisted in selecting from among a wide variety of quality or grade differences the particular qualities or grades most desired;

(2) increase or improve the precision with which preferences are transmitted through the marketing system to producers;

(3) facilitate trading between buyers and sellers;

(4) assist producers in making decisions concerning the use of their productive resources.[5]

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[4]When the price mechanism is functioning efficiently, with given conditions of supply and demand, the price that clears the market and leaves no buyers unsatisfied is not "determined" but "discovered" as sellers do not make or create demand.

Buyers have different tastes and / or purchasing
powers and use products for many different purposes. The
sale of a commodity by grades enables the different types of
buyers to meet their individual requirements. As a corollary,
grading permits sellers to take maximum advantage of market
preferences for different qualities and facilitates more
effective distribution by sellers. Theoretically, therefore,
uniform grades for a commodity increases the efficiency with
which prices distribute various segments of the supply of the
commodity among competing end users. This is made possible by
the fact that uniform grades, by definition, subdivide a more
or less heterogeneous supply of a product into more uniform
or homogeneous groupings on the basis of quality character-
istics. Grades need not imply any order of quality to increase
pricing efficiency. Grades need only to demarcate which units
of a commodity are economically different from other units,
with respect to particular attributes. In this way they enable
consumers to choose more rationally from among the various
grades for the particular attributes. As a result, the
probability, that each unit of the commodity will be marketed
on the basis of its highest and best use is increased. This
in turn, from a generalized welfare viewpoint suggests an
improvement in marketing efficiency.

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[5]United States Department of Agriculture, _Economic
Effects of U. S. Grades for Beef_, Marketing Research
Report No, 298, p. 11.

Supply and demand forces operate both in the presence or absence of a standardized system of grades for eggs. Theoretically, these forces operate more effectively when quality differences are stipulated than when they are not. With grades fixed over time and place in terms of physical attributes of a commodity, price differences between the grades should shift and change in accordance with supply and demand conditions among the grades.

Uniform grade standards are essential to an efficient system of market reporting on prices, supplies available and factors affecting demand. For a product which varies in quality over a wide range, market prices become intelligible and useful only when quoted in terms of specific grades. Homogeneous grouping and subgrouping permit a broader and more accurate application of the concept of market perfection. Price on the basis of grade at any point in time and space can be compared with the same grade at any other point. Accurate and intelligible price reports, in turn provide for more accurate pricing of the product traded.

A uniform grade system provides a common language for buyers and sellers throughout the trade. Theoretically, with such a system the general level of knowledge of all persons in the trade concerning prices, and supply or demand conditions tends to increase. In addition, the level and degree of knowledge between buyers and sellers tend to be equalized.

There are ample indications that the free market pricing system functions more effectively if both buyers and sellers are well informed, and more or less equally informed, concerning grades and qualities of the commodity being traded than if they are ignorant or unequally informed. This gives significance to the aforementioned effects.

II. GRADE SPECIFICATIONS FOR GRADE A EGGS

The grade specifications for eggs are clearly and concisely spelled out in the Regulations respecting the grading, packing, and marking of eggs under the Livestock and Livestock Products Acts, 1939 and Amendments up to December 1957. These regulations respecting the grading, packing, and marking of eggs are listed in Appendix A. Grade specifications are defined as the quality characteristics according to which the products are sorted. The Canadian Standard Egg Grades comprise both compulsory and optional grades. The compulsory grades are Grade A-large size, Grade A-medium size, Grade B, and Grade C.

III. VARIATION IN EGG QUALITY

The grade specifications for eggs permit some within grade variation; more so with shell factors than with quality. Within grade variation, however is held to a minimum and the degree of within grade variation that exists does not in any way affect the applicability and reliability of the grade

standards or the conclusions that may be drawn from the analysis of grade price differentials under the prevailing system of grades and grading.

The predominant method of grading eggs has been candling. In the candling process the grader or candler rates and ranks the eggs on the basis of such characteristics as texture of shell, the size of the air cell, firmness of white, and the outline of the yolk, considering each of these characteristics in relation to the others. Grouping into grades by the process of candling depends on human judgment.

The major criticism of hand grading is that it is subject to variations, due to human errors in skill and knowledge and variations or disagreement in judgment.

Clayton and Cray, in their experiment on the variability in grading to detect the variation that exists between different candlers in the grading of identical samples of eggs, and the influence that this variation has upon the value of the eggs in Ohio, arrived at the following findings:

(1) These tests indicated a wide variation in the grading of identical samples of eggs by different candlers.

(2) The difference in the grading of identical samples of eggs by 27 different candlers was highly significant in all of the 48 tests involved.

(3) There was considerable variation in the candling of the same eggs at different times by the same candler.

While the lapse of 12 to 24 hours between the first and
second grading would presumably result in some lowering
of quality, yet these tests in many instances showed
actual 'up grading' of the eggs on the second test, but
the large number of 'checks' found on the second grading
reduced the value on the second grading.

(4) There was as much variation between candlers in
the classifying of Grade C eggs as there was in the
classifying of Grade A and Grade B eggs.[6]

It is reasonable to assume that the situation in Canada,

regarding variations in hand grading, closely parallels

that of the United States.

In the trade, interior egg quality is determined by

the process of candling. The housewife – the ultimate

consumer – measures egg quality on the basis of break-out

appearance of the egg. A nation wide sampling test was con-

ducted for the purpose of ascertaining the relationships

between candling grade and the broken out measurements of

current receipts at registered grading stations. Some variation

was found from area to area and between different candlers in

the same area, but there appeared to be a very good correlation

between broken out appearance and candled grades. The opinion

of the co-operators in the survey is that egg grading, as at

present practised is reasonably accurate on the basis of albumen

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[6]Clayton, P. C., and Cray, R. E., _Variations in Grading
Eggs_, Ohio Agricultural Experiment Station Research Circular,
No. 57, September, 1958.

quality.[7]

Some dissatisfaction with the mechanics of grading
has been expressed because of the variations in grading
identical samples by the same candlers and of differences
in judgment between candlers. Nonetheless it is generally
agreed that the system of grading, as practised at present,
succeeds, to a remarkable degree, in separating eggs of
different quality and sorting them into homogeneous groups
so as to reflect differences in economic utility.

A penumbra exists over the area of variation in the
average weights of the weight ranges over time for the
different sizes of Grade A eggs. To illustrate, there is no
evidence to disprove or verify whether the average weight of
a dozen eggs varies significantly from the median of the
weight range for a given size of eggs as the production
period advances. Grade A-medium eggs weigh from 21 ounces
up to but not including 24 ounces per dozen with an average
weight of about $22\frac{1}{2}$ ounces per dozen. It is not known
whether the average weight for this size stays around $22\frac{1}{2}$
ounces per dozen for the entire production period or
approaches the lower limit at the earlier stages of production
and the upper limit as the season advances. This area of
uncertainty will not significantly affect the analysis when

[7]Rae, W. J., "Egg Grading and Quality Control"
Agricultural Institute Review, March - April, 1959.

the median of the weight range is used to represent the
weight per dozen of the particular size as eggs generally
are not bought or sold on a cost per pound basis.

IV. DIFFERENCES IN FORM OF GRADE "A" EGGS

Differences in form of eggs are reflected in the
quality and or, quantity of the edible matter contents
of the shell egg. Eggs are sorted qualitatively into
homogeneous groups on the basis of quality and shell factors,
and quantitatively on the basis of weight. The regulations
governing the grading, packing and marking of eggs clearly
state that all eggs bearing the grade designation "A" must
comply with the following quality specifications:

> Yolk outline indistinct; yolk round in shape and
> reasonably centred; show no germ development or readily
> visible defects or abnormal conditions; air cell shall
> not exceed 3/16 inch in depth; floating air cells, blood
> spots and meat spots are not permitted.[8]

The shell specifications to which all Grade A eggs must
comply in order to be classified as properly branded are
listed in the Regulations in Appendix A. In addition, a
further guarantee of uniformity of quality over time for eggs
designated as Grade A stems from the fact that the regulations
state:

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[8]Regulations regarding Grading, Packing and Marking of
Eggs. Appendix A.

... with respect to the quality factor, the seller
shall be deemed to have misbranded any eggs, which
within thirty-six hours after delivery by him, are
found to be below the grade stated on the container at
the time of delivery...[9]

All eggs which are branded as Grade A must, therefore, be homogeneous in terms of quality and shell factors since any deviation from the grade specifications implies that the eggs are misbranded. There is no difference in quality — overlooking very minor within grade variation — in eggs which are classified as Grade A. On the basis of quality there is no difference in form of Grade A eggs. The implication is that since there are no differences in quality of eggs designated as Grade A there can be no differences in economic utility arising out of variation in the quality characteristics that Grade A eggs possess. Because of the homogeneity of quality in Grade A eggs, the inference is drawn that there is no justification for the existence of price differentials between large, medium and small Grade A eggs on the basis of differences in economic utility arising out of variations in quality attributes.

Quantitatively, differences in form are characterized by differences in yield of the edible matter contents of the shell egg. Egg weight and thus edible matter content varies

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[9]Regulations regarding Grading, Packing and Marking of Eggs. Appendix A.

directly and proportionally with egg size. "The relative amount of shell is the same in hen's eggs of all sizes."[10] The larger or the heavier the egg, the greater the amount of food material the egg contains. Large, medium, and small, the sizes of Grade A eggs of immediate concern in this study are obtained by taking together both compulsory and optional grades.

Grade A large size weigh individually at the rate of 24 ounces and over per dozen and up to but not including 27 ounces as Grade A extra large weigh individually at the rate of 27 ounces or over. The average weight of one dozen Grade A large eggs approximates $25\frac{1}{2}$ ounces. Grade A-medium size weigh individually at the rate of 21 ounces per dozen and up to but not including 24 ounces per dozen with an average weight of approximately $22\frac{1}{2}$ ounces per dozen. Grade A-small size average approximately $19\frac{1}{2}$ ounces per dozen and weigh individually at the rate of 18 ounces per dozen and up to but not including 21 ounces per dozen. It is always more difficult to work with a range than it is to work with a single figure. For the purpose of simplification, the mid-point of the weight range of each size of eggs is assumed to be the average weight for that size. For example, a dozen Grade A-medium eggs

[10]Romanoff, A.L., and Romanoff, A.J., The Avian Egg, John Wiley and Sons, New York, 1949, p. 116.

instead of weighing individually at the rate of 21 ounces up to but not including 24 ounces are assumed, throughout the study, to weigh $22\frac{1}{2}$ ounces per dozen, the weight at the mid-point of the class interval. In a similar manner the weight of a dozen Grade A-large eggs is assumed to be $25\frac{1}{2}$ ounces and Grade A-small $19\frac{1}{2}$ ounces. These assumptions regarding average weights for each size are somewhat arbitrary but the possible errors involved are probably of negligible importance. Analysis of differentials would be in error only if departures from true mean weight were significantly different for each weight class since the relationships between the sizes then become highly variable and the basis of the standard then becomes questionable.

With Grade A-large eggs as the base equal to 100, Grade A-medium eggs are approximately 88 per cent and Grade A-small approximately 76 per cent as heavy as Grade A-large. These percentages are rounded to the nearest integer. Edible matter content of the shell egg varies directly and proportionately with egg weight or egg size. Assuming eggs are valued on a weight basis A-medium eggs are worth 88 per cent of A-large or 12 per cent less than A-large, whereas the value of A-small is 24 per cent less than the value of A-large. These differences in yield of edible matter contents in large, medium and small Grade A eggs provide a numerical measure of the differences in form of Grade A eggs.

CHAPTER III

THEORY AND METHODOLOGY

In the analysis of a normative type problem an ideal or standard has to be established with which observed phenomena are compared and plausible explanations advanced to account for observed deviations from the "ideal" or standard. The standard selected is that of a perfect market. The abstract concept of the perfect market provides a standard from which to measure aberrations in prices.

I. THEORY OF THE PERFECT MARKET[1]

A market is defined as "a group of men (or women), a group of buyers and sellers with facilities for trading with each other."[2] They may be located at a single focal point or may be scattered over a wide geographic area. The important factor, which defines a market, is the closeness of the communication between the men and women in it. The distinguishing characteristic of a perfect market is that all the buyers and sellers in it possess perfect knowledge of demand, supply, and price and act rationally upon that

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[1]The discussion on the theory of the perfect market draws on Shepherd, G. S., _Marketing Farm Products_, Iowa State College Press, 1947, Appendix A.

[2]Shepherd, _op. cit._, p. 400.

knowledge. In such a market a uniform price prevails. It
follows that as the more nearly a market approaches perfection,
the greater is the tendency for the same price to be paid
for identical commodities at the same point of time in all
parts of the market.

The buyers and sellers, who make up the market for a
particular commodity, are not generally located in a single
place, but are usually scattered over a large area. The
uniform price which distinguishes a perfect market is uniform
over the area plus or minus any necessary transportation
and handling charges between buyers and sellers in different
parts. As a rule, buyers and sellers in a market do not
transact business at one point in time. The more realistic
approach is for business in a market to be carried out in
the form of a series of transactions over a period of time.
In a perfect market the price is uniform over a period of
time plus or minus the storage charges involved in carrying
some of the commodity over from periods of relative
abundance to periods of relative scarcity. Shepherd points
out that "the problem of market perfection over a period of
time is also complicated by the fact that even after a market
has done a perfect job of discounting the (predictable)
future, unpredictable events may change the picture later
on."3 A perfect market also results in a uniform price for

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3Shepherd, op. cit., p. 407.

a commodity plus or minus appropriate price differentials
for different classes and grades within that commodity.

The perfect market is a suitable standard, from which
market imperfections can be measured, because of the fact
that a perfect market exists only under perfect competition.
The peculiar attractiveness of perfect competition as a
standard or "ideal" is that in a state of perfect competition
the marginal conditions for maximum welfare are fully
satisfied. The marginal conditions of maximum welfare are
summarized in appendix B. Perfect competition is attained
when the following conditions are fulfilled:

(1) An economy made up of a large number of units;

(2) complete mobility of factors and products;

(3) factors and products are substitutes;

(4) free entry; and,

(5) perfect knowledge on the part of all buyers and
sellers about conditions in the market.[4]

A large number of firms in an industry insures that
the action of any one firm will have no noticeable effect on
the price and output of the industry. The individual firm
has to take the price of the product as a datum. The price
of the product is the same for all firms comprising the

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[4]Stonier, A. W., and Hague, D. C., A Textbook of
Economic Theory, Longmans Green and Co., 1953, Chap. VI.

industry. The condition of free entry permits any one willing and capable of entering the industry to do so. This condition provides for the number of firms in a competitive industry to remain large. Complete mobility of factors and products assumes no transportation cost, and assures homogeneity of factors and products. Two items are not homogeneous in terms of economics if they are not in the same place. Acceptance of products as being homogeneous by consumers deters an entrepreneur from raising the price of the product above the general level. A uniform price prevails throughout the market for homogeneous products and factors. Perfect knowledge on the part of buyers and sellers is a prerequisite for a uniform price prevailing in the market for a commodity. No buyer pays more and no seller accepts less than the prevailing market price.

Every consumer in maximizing welfare makes the marginal rate of substitution between any pair of products equal to the ratio of their prices. Under perfect competition the price of any product and thus the price ratio of any pair of products is the same to every consumer. It follows that the marginal rate of substitution between any two products must be the same for every individual who consumes both; one of the necessary conditions for the attainment of maximum welfare. When perfect competition prevails the marginal rate of transformation between any pair of products equals the

ratio of their prices. Under perfect competition the price
of any product and thus the price ratio of any pair of products
is uniform throughout the market, so that the marginal rate of
transformation between any pair of products must be the same
for any two firms which produce both. The important
characteristic of both perfect competition and the perfect
market is that a uniform price prevails for a commodity.
This characteristic enables the marginal conditions for
maximum welfare to be fully satisfied. The fact that in a
perfect market the conditions for maximum welfare are satisfied
makes the perfect market a suitable standard from which to
measure imperfections in prices.[5]

11. PERFECT MARKET WITH RESPECT TO FORM

A perfect market with respect to form has been defined
as one which results in a uniform price for a commodity plus
or minus appropriate price differentials for different classes
and grades within that commodity. Grade A eggs are homogeneous
in terms of quality, but are grouped into three sizes— large,

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[5]The above discussion is confined to only 2 marginal
conditions. Melvin W. Reder, Studies in the Theory of Welfare
Economics, Columbia University Press, New York, Chap. 3, from
which the discussion of the relationship of perfect competition
and the marginal conditions for maximum welfare is drawn, gives
proof, for each condition separately, that under perfect compet-
ition the marginal conditions for maximum welfare are satisfied.

medium, and small, on the basis of weight. Using A-large, as a standard equal to 100, A-medium eggs are 88 per cent as heavy, while A-small eggs are only 76 per cent as heavy as A-large eggs.

There is a constant percentage relationship between egg weight and edible matter content of the shell egg so that A-medium eggs contain only 88 per cent of the food material available in A-large; whereas A-small eggs yield only 76 per cent as much as A-large eggs. In the perfect market it is assumed that the buyer has perfect knowledge of demand, supply, and price and acts rationally on the basis of that knowledge. Since Grade A eggs are homogeneous in terms of quality, on the basis of weight, the appropriate price differentials between large, medium, and small Grade A eggs are for A-medium eggs to be valued at 88 per cent and A-small eggs valued at 76 per cent of the price of A-large eggs. Hypothetical prices are used in a simple illustration. If the price of A-large eggs is 25 cents per dozen then in a perfect market, assuming perfect knowledge and rational behaviour on the part of every consumer, the price per dozen for A-medium eggs is 22 cents or 88 per cent of 25 cents. Similarly the price per dozen for A-small is 76 per cent of 25 cents - the price of A-large - which is 19 cents. In the analysis of actual market data, in order to compute real or expected price differentials between the various sizes of

Grade A eggs, on the basis of weight and using A-large as the base, the assumption is made that the market is performing its function perfectly in establishing the prices of Grade A-large eggs.

III. THEORETICAL REQUIREMENTS OF STATISTICAL MEASURES

The perfect market requires that the cross elasticity of demand between large, medium, and small Grade A eggs be positive and infinite. The implication is that if the price ratio between the three sizes of Grade A eggs gets out of line buyers shift their purchases from one size to the other. In this way they bring about adjustment to maintain the given price relationships. The ratio of A-medium egg prices to the prices of A-large is out of line if this ratio assumes any value other than 88 per cent. Similarly the ratio of A-small egg prices to A-large egg prices is out of line if this ratio has a numerical value other than 76 per cent. To illustrate, if the price ratio of A-medium to A-large eggs is less than 88 per cent, theoretically, buyers shift their purchases from A-large to A-medium. If the price ratio of A-medium to A-large exceeds 88 per cent then the reverse situation prevails; that is, a shift from A-medium to A-large.

To take the argument one step further, in the perfect market the relative quantities supplied of the three sizes of Grade A eggs do not affect the price ratios

between the sizes of A grade eggs. The underlying assumption is that of perfect substitutability between large, medium and small A grade eggs. Regardless of the relative supply of the sizes of Grade A eggs, if consumers regard large, medium and small eggs as perfect substitutes for each other the market forces should operate to maintain the AM/AL price ratios at 88 per cent and the AS/AL price ratios at 76 per cent in the perfect market. The price ratios are unaffected by the relative supply of medium and small eggs to large eggs. Theoretically, therefore, statistical measures are required to reflect a constant price ratio between the sizes of A grade eggs regardless of variations in the relative quantities of the different size groups of eggs that are marketed.

The assumption of perfect substitutability between Grade A eggs implies that the final consumer may be willing to substitute one small egg and a portion of another for a large egg. The assumption that large, medium and small eggs are perfect substitutes for each other is not very realistic as an egg is a unit not easily divisible into smaller portions. Besides the problems created by discontinuities in egg sizes, there are subjective factors which tend to affect the degree of substitution between the sizes of A grade eggs. For example, a housewife may serve one large egg but may be reluctant to serve a small or a medium egg. She may feel that serving small or medium eggs instead of large eggs may be misconstrued

as signs of financial hardship. Coupled with the reluctance
to serve a small egg may be the obligation to serve more
than one small egg.

Objectively, to some families absolute expenditure is
the important factor in making a decision to purchase any
given product. Assuming that the attitude of being obligated
to serve two small eggs or one large egg is fairly widespread;
then even though the relative value of small eggs may be in
line with large eggs, that is 76 per cent on the price of
large eggs, the absolute expenditure on two cartons of small
eggs is greater than the expenditure on one carton of large
eggs. Small eggs may have to be heavily discounted before
such a family considers a shift of purchases from large to
small eggs. The argument is the same for medium eggs.

The subjective and objective factors associated with
discontinuities of egg sizes suggest that large, medium and
small eggs are not perfect substitutes for each other. The
effect is that there is no automatic tendency for market
forces to operate to maintain the theoretical price relation-
ship between large, medium, and small Grade A eggs, in which
mediums are 88 per cent and small 76 per cent of the price of
A-large eggs. With large, medium and small eggs close but
less than perfect substitutes for each other, the relative
supply of each size of eggs tend to affect the price ratios.
The subjective factors associated with the discontinuity of

in the marketing system. Some margins are absolute per unit
charges, that is, fixed in amount regardless of changes in
the retail prices of the products marketed. Others are
straight percentage margins, varying proportionately with
changes in retail prices. Still others are in the nature of
a compromise between absolute per unit charges and straight
percentage margins. Marketing margins, of the nature of
absolute per unit charges or which contain both absolute
per unit charges and percentage elements, alter the price
ratio at the producer level. Marketing margins of the
nature of absolute percentages do not alter the price ratio
at the producer level. With straight percentage margins
the price ratios are the same at both consumer and producer
levels. The second condition necessary to satisfy the
requirements of the standard, that the price ratios at the
producer level between A-medium and A-large and A-small
and A-large are 88 and 76 per cent respectively, is straight
percentage margins varying proportionately with changes in
retail prices.

Hypothetical price ratios serve to illustrate the
effects of flat margins and percentage margins on producer
price ratios between the three sizes of Grade A eggs.[6]
Hypothetically, the retail price of A-large is 51 cents per

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[6]All ratios rounded to the nearest integer.

dozen. For A-medium the retail price is 45 cents. The hypothetical price ratio of medium to large eggs is 45/51 or 88 per cent. The hypothetical margin between retail and producer levels is 19 cents. The price received by producers for A-large eggs is 51 cents minus the margin of 19 cents or 32 cents. The price received by producers for A-medium is 26 cents or 45 cents minus the margin of 19 cents. At the producer level, the price ratio between A-medium and A-large eggs is 26/32 or 81 per cent. The difference in the price ratios of A-medium to A-large between the retail level and the producer level is therefore 88 per cent minus 81 per cent or 7 per cent. The producer price ratio is 7 per cent lower than the retail price ratio. For A-small eggs the hypothetical price at retail is 39 cents. At retail the hypothetical price ratio of A-small to A-large eggs is 39/51 or 76 per cent. Assuming the same flat margin of 19 cents the prices paid to producers for A-small eggs are 20 cents. At the producer level the price ratio of small to large Grade A eggs is 20/32 or 63 per cent. The difference between the retail and producer price ratios of small to large Grade A eggs is 76 minus 63 per cent or 13 per cent. The producer price ratio of small to large is not only lower than the corresponding retail price ratio but is even more depressed than the A-medium to A-large producer price ratio.

Flat margins alter the price ratios at the producer

level by exerting a downward pressure on the producer price ratios. The effect of flat margins on ratios is such that, when flat margins exist, the producer price ratios are always lower than the corresponding retail price ratios for Grade A eggs. In addition the producer price ratios for A-small to A-large are more highly distorted than the producer price ratios of A-medium to A-large eggs.

Absolute percentage margins do not affect the price ratios at the producer level. The hypothetical margin between retail and producer prices is 36 per cent of the retail price. The prices paid to producers is therefore 64 per cent of the retail prices. The producer price is 64 per cent of 51 cents for A-large; 64 per cent of 45 cents for A-medium, and 64 per cent of 39 cents for A-small. This results in prices paid to producers of 33 cents for A-large, 29 cents for A-medium, and 25 cents for A-small. At the producer level, the hypothetical price ratio between medium and large Grade A eggs is 29/33 or 88 per cent. Similarly the producer price ratio of A-small to A-large is 25/33 or 76 per cent. The ratio of prices at the producer level is the same as the ratio of prices at the retail level. Absolute percentage margins do not alter the producer price ratios.

Selection of Price Series

The price series selected for analysis has to satisfy the theoretical requirements of satistical measures as

outlined.

Weighted Average Price. In a study of price differ-
entials the use of weighted average prices introduces a
bias when price levels and quantity marketed vary daily,
seasonally and about the secular trend. The extent of this
bias as Weijs points out depends on:

(1) the extent of the variation in the relative
quantity...;

(2) the extent to which the price level varies;

(3) the frequency with which the price level changes;
and,

(4) the extent to which errors cancel each other out.[7]
The bias introduced by using weighted average prices in a
price differential study of this kind is considerable, mainly
because of the wide variability that exists between the
relative quantities of the various sizes of eggs available
for market over time.

The wide variability that exists in the availability
of the relative quantities of the different sizes of eggs,
to a large extent, is due to the seasonal nature of the
production pattern. As a result of the nature of the

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[7]For a detailed discussion on bias introduced in a study
of price differentials by using weighted average prices see
Weijs, Jan Harry J. M., "A Study of Steer Heifer Price
Differentials", unpublished M.Sc. thesis, University of
Manitoba, 1957.

The proportion of A-medium eggs to A-large eggs is first assumed to be 20 per cent, than varied to 96 per cent. The price ratio of A-medium to A-large eggs is maintained at 88 per cent. The ratio of the weighted average price of A-medium eggs to the weighted average price of A-large is 73 per cent. Variation in the proportion of the supply of A-medium to the supply of A-large eggs induced a change in the price ratio. A difference of approximately 15 per cent points is obtained in the price ratio of weighted average prices when the supply of A-medium relative to A-large is not held constant at 20 per cent, but varied from 20 per cent to 96 per cent.

A-LARGE		A-MEDIUM		PRICE RATIO
Quantity	Price	Quantity	Price	
400	34	80	30	88
600	21	576	18	88
Weighted		Weighted		
Ave. Price	26	Ave. Price	19	73

The error, which is likely to be introduced by selecting as the price series for analysis weighted average prices, is quite significant. The change induced in the ratio of weighted average prices, when the relative proportions of the quantities supplied are varied, makes it impossible to use a weighted average price series and obtain a satisfactory standard in terms of the theoretical requirements that the price ratios between large, medium, and small eggs is constant; nor does it permit any meaningful comparisons to be made to a standard in which the price ratio is in itself

variable.

Monthly prices. A monthly price series, in which the
price on the first Tuesday of the month is taken as represent-
ative of the prices prevailing during the month, is devoid
of the inherent bias in using a weighted average price series
in a study of price differentials. A monthly price series
satisfies the theoretical requirements of statistical measures
as outlined, in that it is capable of reflecting, in theory,
a constant price ratio between the sizes of Grade A eggs
regardless of the variations in the relative quantities of
large, medium, or small eggs marketed.

A possible source of error in using a monthly price
series, in which the price on the first Tuesday is taken as
representative of the prices prevailing during the month,
arises from the degree to which the price on the first Tuesday
represents the average of the prices which prevail during the
month. In order to determine whether the price on the first
Tuesday of the month – the monthly price – differs
significantly from the prices established on the other
trading days during any given month, the monthly price, as
represented by the price on the first Tuesday of the month,
is compared statistically by means of the t-test with the
average price for four week periods for the years 1953 to
1957. At the 5 per cent level of significance there is no
significant difference between the monthly price, as

represented by the price on the first Tuesday, and the simple
averages of 4 week periods for Grade A-large eggs. For Grade
A-medium and Grade A-small, there is no significant difference
at the 5 per cent level between the monthly price and the
simple average price for four week periods. The conclusion
is drawn that for 95 per cent of the time the result is the
same if either the monthly price, as represented by the price
on the first Tuesday, or the simple average of 4 week periods
is used.

Another statistical test of comparison is carried out.
The year 1954 is selected at random from the years 1952 to
1957 and the monthly price - the price on the first Tuesday-
is compared to the simple average of daily prices for each
month of the year. For A-large eggs, there is no significant
difference at the 5 per cent level between the monthly price
and the simple average of daily prices for the month. For
A-medium and A-small, there is no significant difference at
the 5 per cent level between the simple average of daily
prices and the respective monthly prices. The conclusion
is that for the year 1954 there is no significant difference
between monthly prices as represented by the price on the
first Tuesday and monthly prices as represented by the
simple average of daily prices during the month. The
general conclusion is that there is no significant difference
between the first Tuesday price and the 4 week average price

or the simple average of daily prices. The monthly price,
as represented by the price on the first Tuesday, is
representative of the prices prevailing during the month.
The error which is introduced in the analysis, in using the
price on the first Tuesday of the month as being the average
of the prices for the month, can be ignored.

CHAPTER 1V

AN ANALYSIS OF GRADE PRICE DIFFERENTIALS

Differences in the relative prices of large, medium
and small Grade A eggs are of importance in determining the
profitability of each size to producers, and in giving some
indication of consumer preferences for a commodity, which is
homogeneous in terms of quality, but clearly identifiable on
the basis of size.

1. DESCRIPTION OF PRICE DIFFERENTIALS

Medium to large retail price differential. The
differences between the prices of A-large eggs and the prices
of A-medium eggs range, at the retail level in the marketing
system, from 1 cent per dozen up to 11 cents per dozen.
Retail price differentials are shown in Figure 1. At retail,
the price differentials between A-large and A-medium eggs
average 3.66 cents per dozen. Reference to Table II shows
that a difference of 2 cents per dozen between the prices of
A-large and the prices of A-medium eggs occurs most frequently
at retail. The price differential of 2 cents is often maintained
even though the prices of A-large eggs vary over the period.
For example, in 1952 from February to September the prices
of A-large eggs vary from 44 cents to 60 cents per dozen but
the retail price differentials between A-large and A-medium

TABLE II

FREQUENCY DISTRIBUTION OF MEDIUM TO LARGE
RETAIL PRICE DIFFERENTIALS, 1952-1957*

PRICE DIFFERENTIAL IN CENTS/DOZEN	FREQUENCY
1	2
2	35
3	12
4	3
5	4
6	4
7	3
8	6
9	0
10	2
11	1

*Based on data from The Poultry Products Market Review, 1952 to 1957. The frequencies represent 72 monthly observations.

eggs remain fixed at 2 cents per dozen.

Medium to large, retail price ratios. The AM/AL
retail price ratios range from a low of 78.7 per cent to a
high of 98.2 per cent. The AM/AL retail price ratios average
over the period under study 93.4 per cent. On the average,
the prices of A-medium eggs are 6.6 per cent lower than the
prices of A-large eggs at the retail level. Theoretically
the prices of Grade A-medium eggs should be 88 per cent of
the prices of Grade A-large eggs. In other words, the prices
of A-medium eggs should be 12 per cent lower than the prices
of A-large. The actual market data indicates that the prices
of Grade A-medium eggs are only 6.6 per cent lower than the
prices of Grade A-large eggs at the retail level of the
marketing system. The moving average of the price ratios are
shown in Figure 5.

In accordance with the theoretical standard, the
appropriate differential between the prices of A-medium eggs
and the prices of A-large eggs is 12 per cent of the prices
of A-large eggs. The prices of A-medium relative to A-large
prices are 5.4 per cent above the theoretical level as
determined by differences in weight or food content between
large and medium eggs. Relative to A-large eggs, A-medium
eggs tend to be overvalued at the retail level at the rate
of approximately 5 per cent of the value of A-large eggs.

Small to large, retail price differentials. The average price differential between A-large eggs and A-small eggs, at the retail level, is 12.16 cents per dozen. The spread between the retail prices of A-small eggs and of A-large eggs ranges from 3 cents per dozen to 26 cents per dozen. This is shown in Figure I. It is evident from Table III that there is a great amount of variability in the price differentials between A-large and A-small eggs at the retail level of the marketing system. Spreads of 9 to 10 cents per dozen between the prices of A-large and A-small eggs occur most frequently.

Small to large, retail price ratio. At retail, buyers express their preferences for Grade A eggs such that the AS/AL price ratios average 78.7 per cent. Actual marketing data show that at the retail level the price differentials between small and large Grade A eggs average approximately 21 per cent of the prices of A-large eggs. The AS/AL retail price ratios range from a low of 60.6 per cent to a high of 93.5 per cent. The prices of A-small eggs range from 39.4 per cent below the prices of A-large eggs up to 6.5 per cent below the prices of large Grade A eggs. Theoretically, the appropriate price differential between the prices of A-small eggs and the prices of A-large eggs, at the retail level, is 24 per cent of the prices of A-large eggs. A comparison of the actual market

price differentials to the theoretical price differential
suggests that, at the retail level, small Grade A eggs are
overvalued approximately 3 per cent in relation to the value
of large Grade A eggs. The trend, however, is one of undervaluation.

TABLE III

FREQUENCY DISTRIBUTION, A-SMALL TO A-LARGE,
RETAIL PRICE DIFFERENTIALS 1952-1957*

PRICE DIFFERENTIALS IN CENTS/DOZEN	FREQUENCY
1 - 2	0
3 - 4	4
5 - 6	7
7 - 8	9
9 - 10	16
11 - 12	12
13 - 14	2
15 - 16	5
17 - 18	4
19 - 20	3
21 - 22	3
23 - 24	5
25 - 26	2

*Based on data from The Poultry Products Market
Review, 1952 to 1957. The frequencies represented 72
monthly observations.

Medium to large, producer price differentials. The
differences between the prices paid to producers for A-medium
eggs and the prices paid to producers for A-large eggs range
from a low of 1 cent per dozen to a high of 10 cents per
dozen. Figure 2 gives the producer price differentials.

A-large —
A-small
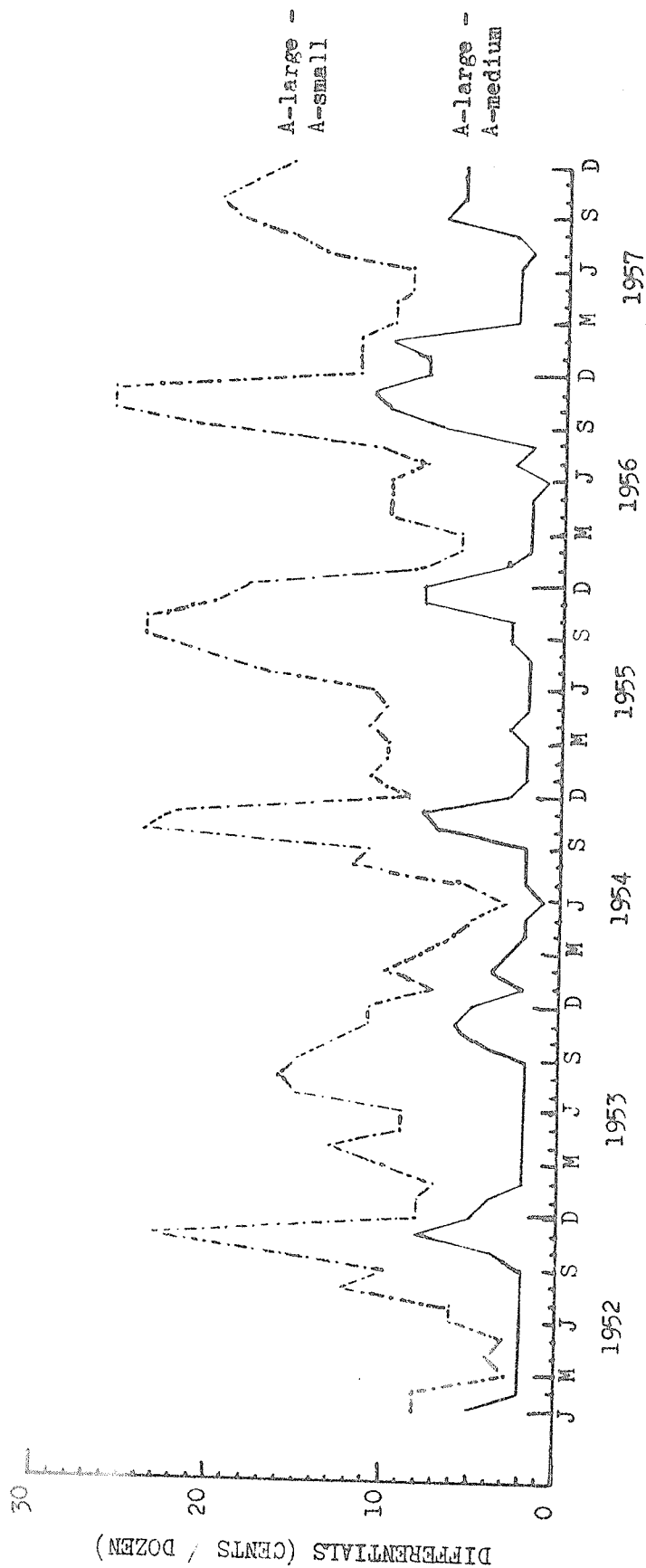
A-large —
A-medium

FIGURE 1

A-MEDIUM/A-LARGE, A-SMALL/A-LARGE RETAIL PRICE
DIFFERENTIALS, WINNIPEG, 1952-1957
(Source: Appendix Table IX)

30

20

10

0

DIFFERENTIALS (CENTS / DOZEN)

J M J S D M J S D M J S D M J S D M J S D M J S D

1952   1953   1954   1955   1956   1957

The differences in the producer prices for A-medium eggs and the producer prices for A-large eggs average 3.59 cents per dozen. A difference of 2 cents per dozen between the producer prices for A-medium eggs and the producer prices for A-large eggs occurs most frequently. In a manner very similar to the retail price differentials, the producer price differentials between A-large and A-medium often remain at 2 cents per dozen despite variations in the prices paid to producers for A-large eggs. The frequency distribution of the producer price differentials between medium and large Grade A eggs is shown in Table IV.

TABLE IV

FREQUENCY DISTRIBUTION, PRODUCER PRICE DIFFERENTIALS,
A-LARGE A-MEDIUM EGGS, 1952-1957*

PRICE DIFFERENTIALS IN CENTS/DOZEN	FREQUENCY
1	1
2	39
3	7
4	5
5	3
6	6
7	3
8	6
9	1
10	1

*Based on data from The Poultry Products Market Review, 1952 to 1957. The frequencies represent 72 monthly observations.

<u>Medium to large, producer price ratios</u>. On the
average, at the producer level in the marketing system, the
A-medium/A-large price ratios are 90.2 per cent. The actual
producer price differentials between A-large and A-medium
eggs average 9.8 per cent of the prices paid to producers
for A-large eggs. The AM/AL egg price ratios at the producer
level range from a low of 73.3 per cent to a high of 97.6
per cent. The producer price differentials between large and
medium A grade eggs, therefore, range from 26.7 per cent of
the producer prices for A-large eggs to merely 2.2 per cent
of the producer prices for A-large eggs. On the basis of
differences in weight or food content between large and medium
eggs, the appropriate differential between the producer prices
for A-large eggs and the producer prices for A-medium eggs is
12 per cent of the producer prices for A-large eggs. A
comparison of the actual price differential to the hypothetical
price differential indicates a difference of 2.2 per cent in
favour of A-medium. More precisely, at the producer level
A-medium eggs relative to A-large eggs are overvalued to the
extent of 2.2 per cent.

<u>Small to large producer price differentials</u>. The
producer price differentials between A-small eggs and A-large
eggs have a range of 21 cents, from 5 cents per dozen to 26
cents per dozen as is shown in Figure 2. On the average, the

difference between the producer prices for A-large eggs and
the producer prices for A-small eggs is 12.22. Reference
to Table V shows that the spread of 9 to 10 cents, between
producer prices for A-medium and producer prices for A-large,
occurs most frequently. There is a great deal of variability
in the producer price differentials between small and large
Grade A eggs.

Small to large, producer price ratios. The A-small/
A-large egg price ratios, at the producer level in the
marketing system, average 67.7 per cent. The price differentials,
at the producer level between small and large Grade A eggs,
therefore, average 32.3 per cent of the producer prices for
A-large eggs. The A-small/A-large egg price ratios at the
producer level have a range of 43.9 per cent from a low of 40
per cent to a high of 83.9 per cent. In other words, the
differences between the producer prices for A-small eggs and
the producer prices for A-large eggs have ranged from 60 per
cent of the prices that producers receive for A-large eggs to
16.6 per cent of the A-large producer prices. In accordance
with the theoretical standard, the appropriate differential
is 24 per cent of the prices producers receive for A-large eggs.
When the hypothetical price differential is compared to the
actual differentials prevailing in the market, relative to
the producer prices for A-large eggs, the prices to producers
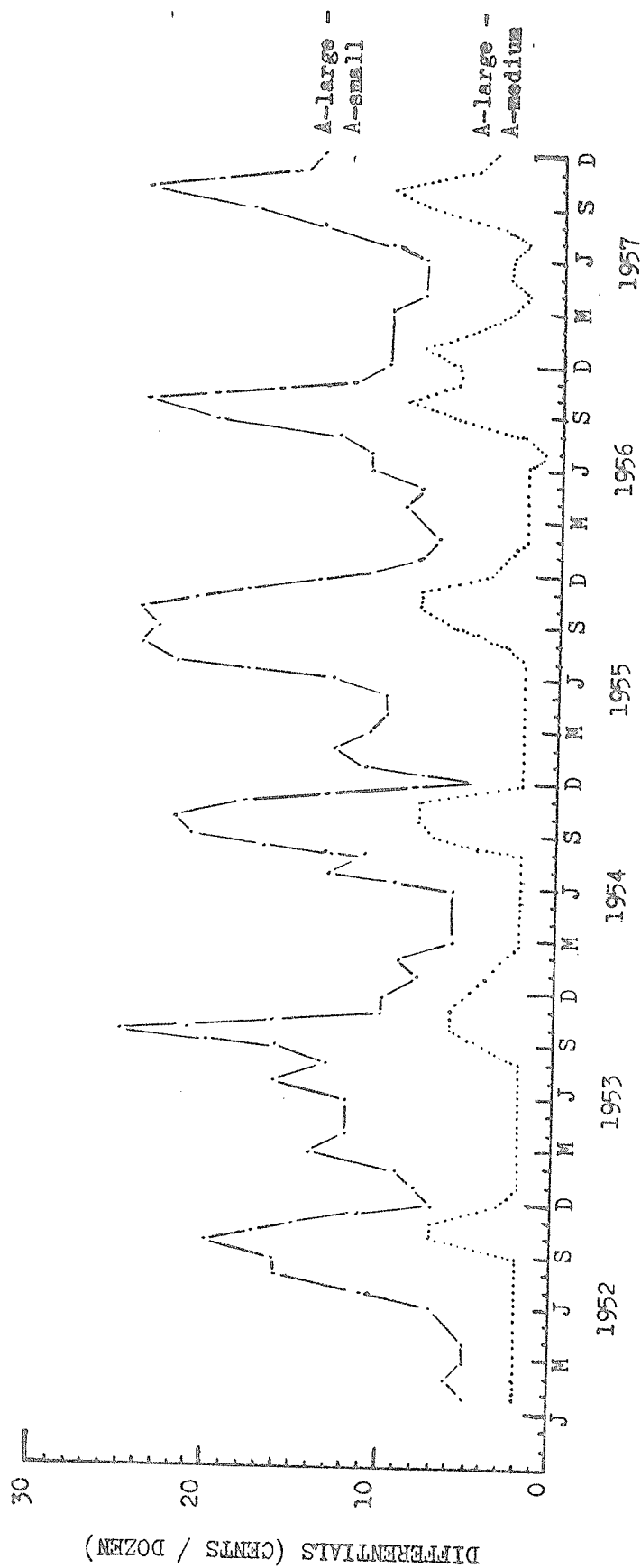
FIGURE 2

A-MEDIUM/A-LARGE, A-SMALL/A-LARGE PRODUCER
PRICE DIFFERENTIALS, WINNIPEG, 1952-1957
(Source: Appendix Table X)

for A-small eggs are approximately 8 per cent below the

expected level. At the producer level, A-small eggs, in

terms of A-large eggs, tend to be undervalued to the extent

of approximately 8 per cent.

TABLE V

FREQUENCY DISTRIBUTION, PRODUCER PRICE DIFFERENTIALS,
A-SMALL-A-LARGE, 1952-1957 *

PRICE DIFFERENTIALS IN CENTS/DOZEN	FREQUENCY
1 — 2	0
3 — 4	0
5 — 6	10
7 — 8	11
9 — 10	12
11 — 12	11
13 — 14	8
15 — 16	6
17 — 18	3
19 — 20	2
21 — 22	3
23 — 24	4
25 — 26	2

*Based on data from The Poultry Products Market
Review, 1952 to 1957. These frequencies represent 72
monthly observations.

The lack of uniformity in the price ratios for eggs

may be partly associated with an irregular flow of the

different sizes of eggs to market. It is, therefore, necessary

to analyse the seasonal pattern in the price differentials

for eggs to reveal conditions under which the price ratios

may depart widely from their theoretical values in a perfect market.

Seasonal Pattern in Grade Price Differentials

Movements of prices within one year or one marketing season are called seasonal price variations. Prices of eggs, price differentials between the sizes of Grade A eggs, as well as many farm products exhibit a fairly regular seasonal pattern because of the seasonal nature of production and the irregular flow of products to market. The seasonal indexes are computed using the ratio to moving average method for continuous series of data. The ratio to moving average method is the most satisfactory method of computing a typical seasonal index. It eliminates from the final expression of seasonal variation the influences of trend, cycle, and irregular factors to a very large degree.[1] In this study, the seasonal indexes are calculated for the period 1952 to 1957. The value for each month in the typical seasonal index indicates the normal price ratio for that month as a percentage of the average for all months. For example, an index of 97 in January for the A-medium/A-large price ratio indicates that averaged over the six years, 1952 to 1957, the price ratio between large and medium Grade A eggs is normally 3

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[1]Neiswanger, W. A., _Elementary Statistical Methods_ The Macmillan Company, New York, 1950, p. 555.

per cent below the yearly average price ratio. Conversely,
an index of 106 in August indicates that August price ratios
averaged 6 per cent higher than the annual average price
ratio. A high price ratio index implies a low price
differential between A-small or A-medium and the base, A-large.

Seasonal pattern, retail price ratios. The prices of
A-medium eggs relative to the prices of A-large eggs reach a
seasonal peak, at retail, of 104 per cent in August and a
seasonal low of 94 per cent in November. Averaged over the
six years 1952 to 1957, the retail price ratios of A-medium
to A-large eggs for the month of August averaged 4 per cent
above the yearly average price ratio. The retail price ratios
of A-medium to A-large averaged, for November, 6 per cent
below the annual average price ratio. The retail ratios
of medium over large A grade eggs, for the months March to
September inclusive, are above the annual average, but from
October to February are below the annual average. The range
in the retail price ratios of A-medium to A-large between the
high and the low months is 10 per cent of the annual average.

The seasonal pattern of the ratios of the retail prices
of A-small eggs to the retail prices of A-large eggs, and of
the retail price ratios of A-medium to A-large eggs are shown
in Figure 3. The retail price ratios of A-small to A-large
eggs vary considerably from 16 per cent below the annual

average in October to 8 per cent above the annual average
in May and June. The range in the retail price ratios of
small to large A grade eggs between the high and low months
is 24 per cent of the annual average. At the retail level,
the A-small/A-large price ratios are above the yearly average
price ratio in the months of January to July inclusive, and
below the yearly average from September to December inclusive.

Seasonal pattern producer price ratios. The normal
seasonal pattern of the producer price ratios between large,
medium and small Grade A eggs is shown in Figure 4. At the
producer level, averaged over the six years 1952 to 1957,
the price ratios of A-medium to A-large eggs reach a seasonal
peak in July of 106 per cent and a seasonal low of 91 per
cent in November. The producer price ratios of A-medium to
A-large eggs are fairly steady for the months of March to
August when the price ratios are above the annual average.
The A-medium/A-large producer price ratios are below the
annual average from September to January with the February
price ratios just equal to the annual average. The range in
the A-medium/A-large producer price ratios from the high to
the low months is 15 per cent of the annual average.

The producer price ratios of A-small to A-large eggs
show a great deal of variation. The price ratios vary season-
ally from 24 per cent below the annual average in October
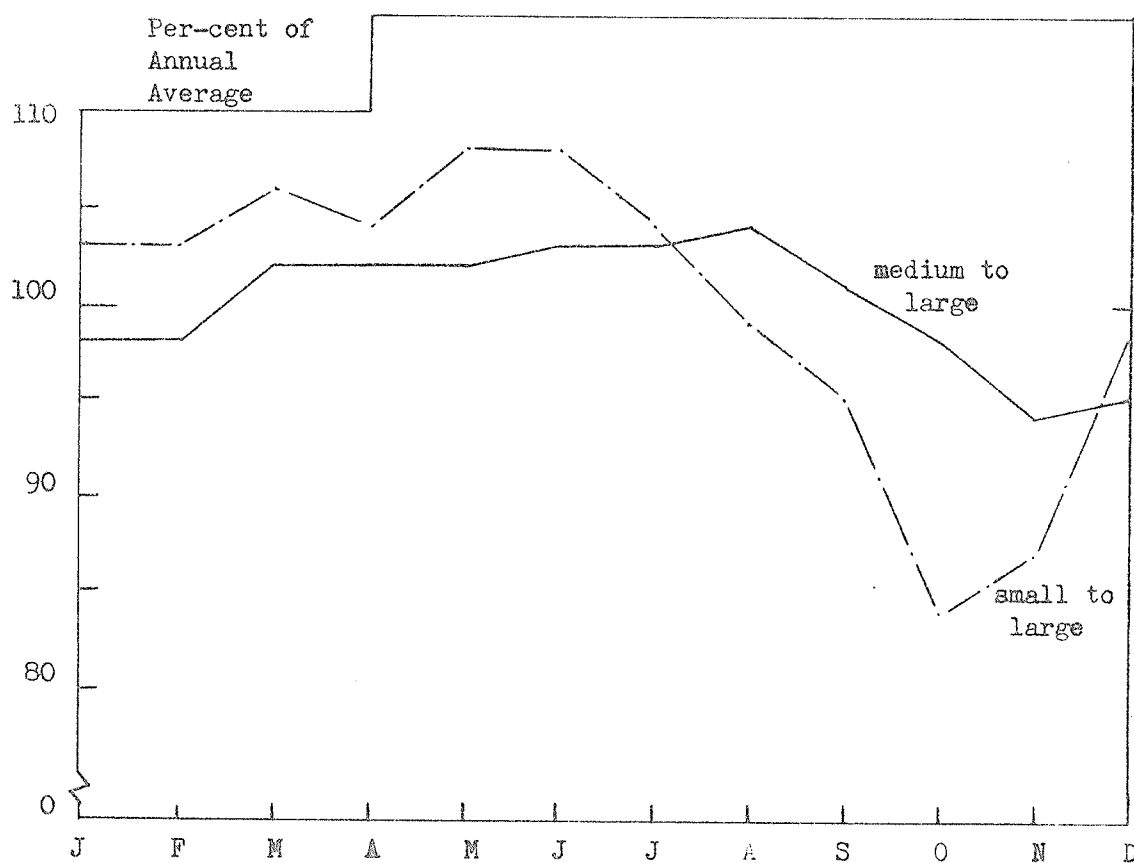
FIGURE 3

NORMAL SEASONAL PATTERN OF RETAIL PRICE
RATIOS, A-MEDIUM TO A-LARGE, A-SMALL
TO A-LARGE, 1952-1957
(Source: Table IX)

to 11 per cent above the annual average in May. The range in
the A-small/A-large producer price ratios between the high
and the low months is 35 per cent of the annual average. The
A-small/A-large producer egg price ratios are above the annual
average in the months December to June but below the annual
average from July to November.

Reliability of seasonal indexes. Typical seasonal
indexes represent the most common pattern and are averages
calculated from indexes for individual years. Generally,
seasonal patterns are influenced by forces which operate
rather uniformly from year to year, so that an average or
typical pattern which is of value in anticipating changes
from season to season within the year can be constructed.
Prices and thus price ratios, in any single year, seldom
follow the average pattern exactly. For some series and for
some months within a single series considerable variations
exist, thereby raising an element of doubt as to the
reliability of the typical pattern. There are many methods
of showing the variations in the seasonal pattern from year
to year. The method used in this study is to calculate the
range within which the actual index is expected to fall in
any month.

Standard deviation calculated for each month measures
the average deviation of the specific seasonal indexes from
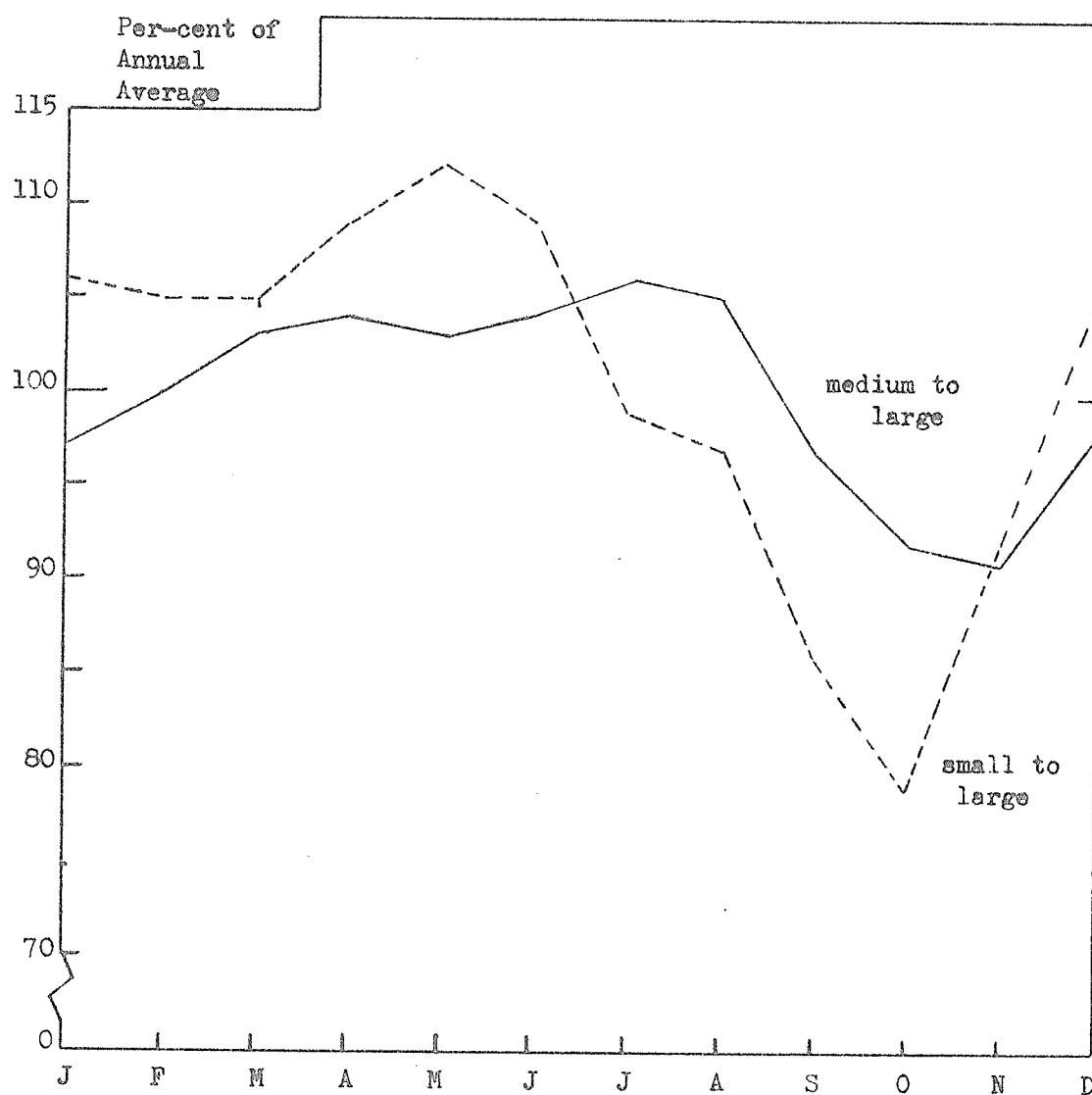
FIGURE 4

NORMAL SEASONAL PATTERN OF PRODUCER PRICE
RATIOS, A-MEDIUM TO A-LARGE, A-SMALL
TO A-LARGE, 1952-1957
(Source: Table X)

the typical seasonal indexes. The average or typical seasonal index and the standard deviations for each month, at both the retail and producer levels, for medium to large, Grade A eggs and small to large Grade A eggs are set out in Tables VI and VII. It is assumed that in two-thirds of the years the actual index for each month is within one standard deviation either way of the average or typical index, or that in 95 per cent of the years the actual index is within two standard deviations. A normal distribution is assumed.

The standard deviation of the A-medium/A-large August retail price ratio index is 1.7. The typical index of A-medium/A-large retail price ratio for August is 104. It is fairly safe to expect that in two-thirds of the years the retail price ratios of medium to large Grade A eggs for August range between approximately 102 and 106 per cent of the annual average. If a greater degree of assurance is required the A-medium/A-large retail price ratio is expected, in 95 per cent of the years, to range between approximately 101 per cent and 107 per cent above the annual average. Similarly, the standard deviation of the retail price ratio of A-medium to A-large eggs for November is 1.4, and the average index is 94. In two-thirds of the years the retail price ratios of A-medium to A-large eggs are expected to range between 93 per cent and 95 per cent of the annual average. In 95 per cent of the years the A-medium/A-large

retail price ratios are expected to be between 91 and 97 per cent of the annual average.

TABLE VI

TYPICAL SEASONAL INDEXES AND STANDARD DEVIATION,
RETAIL PRICE RATIOS, A-MEDIUM / A-LARGE,
A-SMALL / A-LARGE, 1952-1957*

Month	A-MEDIUM / A-LARGE		A-SMALL / A-LARGE	
	Index	Standard Deviation	Index	Standard Deviation
January	98	3.4	103	5.0
February	98	5.2	103	6.3
March	102	1.5	106	3.4
April	102	1.7	104	3.3
May	102	1.5	108	2.1
June	103	1.9	108	4.1
July	103	1.9	104	5.5
August	104	1.7	99	5.8
September	101	2.1	95	6.1
October	98	3.0	84	5.1
November	94	1.4	87	7.6
December	95	3.1	99	4.8

*Based on Appendix Table IX.

The standard deviation, since it is a measure of the variation which exists for any given month, gives a measure of the reliability of the average index for a particular month. For the month of March, the standard deviation of the A-medium/A-large producer price ratio index is 1.5, the lowest value for all months. The index for March is 103 and

is relatively reliable as compared to other months. The A-medium/A-large producer price ratio index for March is fairly certain to be equal or above the annual average. The same degree of assurance cannot be given to other months, for example, January where the standard deviation of the A-medium/A-large producer price ratio index is 6.7 and the index is 97. The producer price ratios of A-medium to A-large eggs for January range from below average to above the annual average. Similarly, the least degree of assurance can be given to the A-small/A-large producer price ratios for December, as compared to the other months, since the index for December is 105 and the standard deviation 12.2, the largest for all months for either retail or producer price ratios.

In the analysis of price differentials for eggs, it is necessary to know whether the differentials have been increasing or decreasing over time. Moving averages passed through monthly price ratios give some indication as to the general movement of the price ratios or the price differentials.

Moving Average of Price Ratios.

A moving average passed through monthly data does not eliminate the trend or the cyclical influences from the series. The centred twelve-month moving average of monthly data approximates a trend-cycle curve. Centred twelve-month moving

averages passed through the ratios of monthly prices are
therefore indicative of the trend and cyclical factors
that affect the monthly price ratios. In a twelve-month
centered moving average six months are lost at the beginning
and at the end of the period. A twelve-month centered
moving average for 1952 to 1957 begins in July 1951 and ends
in June 1958.

TABLE VII

TYPICAL SEASONAL INDEXES AND STANDARD DEVIATIONS,
PRODUCER PRICE RATIOS, A-MEDIUM / A-LARGE,
A-SMALL / A-LARGE, 1952-1957*

| | A-MEDIUM / A-LARGE | | A-SMALL / A-LARGE | |
Month	Index	Standard Deviation	Index	Standard Deviation
January	97	6.7	106	5.8
February	100	2.4	105	4.6
March	103	1.5	105	7.8
April	104	3.2	109	4.9
May	103	1.7	111	4.8
June	104	2.0	109	5.9
July	106	2.5	99	9.7
August	105	1.7	97	10.8
September	97	4.5	86	8.5
October	92	3.4	76	7.6
November	91	4.0	92	4.5
December	98	3.7	105	12.2

*Based on Appendix Table X.

The twelve-month centred moving average of the price ratios for large, medium, and small Grade A eggs at both producer and retail level are shown in Figure 5. The twelve-month centred moving average passed through retail price ratios of A-medium to A-large eggs exhibits a slight downward trend until 1956 when the moving average drops sharply approximately 6 percentage points from February 1956 to March 1957. The moving average of the producer price ratios also exhibit for the same period a drop of almost the same magnitude as the moving average of A-medium to A-large retail price ratio. The downward trend exhibited in the retail price ratios of medium to large Grade A eggs is even more accentuated in the twelve-month centred moving average of A-medium/A-large producer price ratios. The twelve-month centred moving average of both the retail and producer price ratios of small to large Grade A eggs are somewhat similar with both showing a marked downward trend and evidence of strong cyclical tendencies. A downward trend in the twelve-month centred moving average of the price ratios points to increasing differentials in percentage terms between the prices of large, medium and small Grade A eggs.

The twelve-month centred moving averages passed through the actual price differentials between large and medium, and large and small show, in all four cases, an

FIGURE 5

MOVING AVERAGE, RETAIL AND PRODUCER PRICE RATIOS, A-MEDIUM-A-LARGE, A-SMALL-A-LARGE 1952-1957
(Source: Based on data from Poultry Products Market Review, 1952-1957)

upward trend in the price differentials. Reference to
Figures 6 and 7 indicates that the differences between the
prices of large and medium, and large and small Grade A eggs,
at both retail and producer levels, have been increasing in
magnitude between 1952 and 1957.

11. ANALYSIS OF PRICE DIFFERENTIALS FOR GRADE A EGGS

In the description of price differentials for Grade A
eggs, the disparity between the actual price ratios and the
expected price ratios become evident. Theoretically, the
prices of A-medium eggs and the prices of A-small eggs are
expected to be a constant percentage of the prices of Grade
A-large eggs at the retail level and at the producer level if
market charges are proportionate to price. In actual fact,
the price ratios of medium to large and small to large Grade
A eggs are not a constant percentage as expected but vary
considerably from month to month and year to year. In
addition, the price ratios exhibit a steady downward trend.
Before any suggestions to remove imperfections in the
marketing system can be made or before any satisfactory
explanation for the downward trend can be advanced, it is
necessary to determine the factors involved and the degree
to which these factors influence the price differentials
between large, medium and small Grade A eggs.

The assumption that, to the final consumer, large,

medium, and small eggs are close substitutes has a logical
foundation. Grade A eggs, regardless of size, are
homogeneous in terms of quality. Despite the logical base,
the assumption of close substitutability between Grade A
eggs of different sizes is open to question. Even though by
federal statute all Grade A eggs are of the same quality,
because of subjective factors associated with the
discontinuity of egg sizes, small or medium eggs may not be
regarded by the final comsumer as perfect substitutes for
large eggs. A more critical examination of this assumption
leads to the choice of supply as a variable in the attempt
to determine some of the factors which affect the price
ratios.

Theoretically, given the assumption that Grade A eggs
are homogeneous in terms of quality and therefore regarded as
perfect substitutes by the final consumer, the total supply
of eggs available and the relative supply of large, medium
and small Grade A eggs are not expected to exert any
appreciable influence on the A-medium/A-large and A-small/
A-large price ratios. Expectations are not borne out,
however, as both the relative quantities of large, medium
and small Grade A eggs and the total quantity of eggs
available influence to some extent the price ratios between
large, medium and small Grade A eggs.

FIGURE 6

MOVING AVERAGE, RETAIL AND PRODUCER PRICE DIFFERENTIALS
A-MEDIUM - A-LARGE, WINNIPEG, 1952-1957
(Source: Based on data from Poultry Products Market Review, 1952-1957)
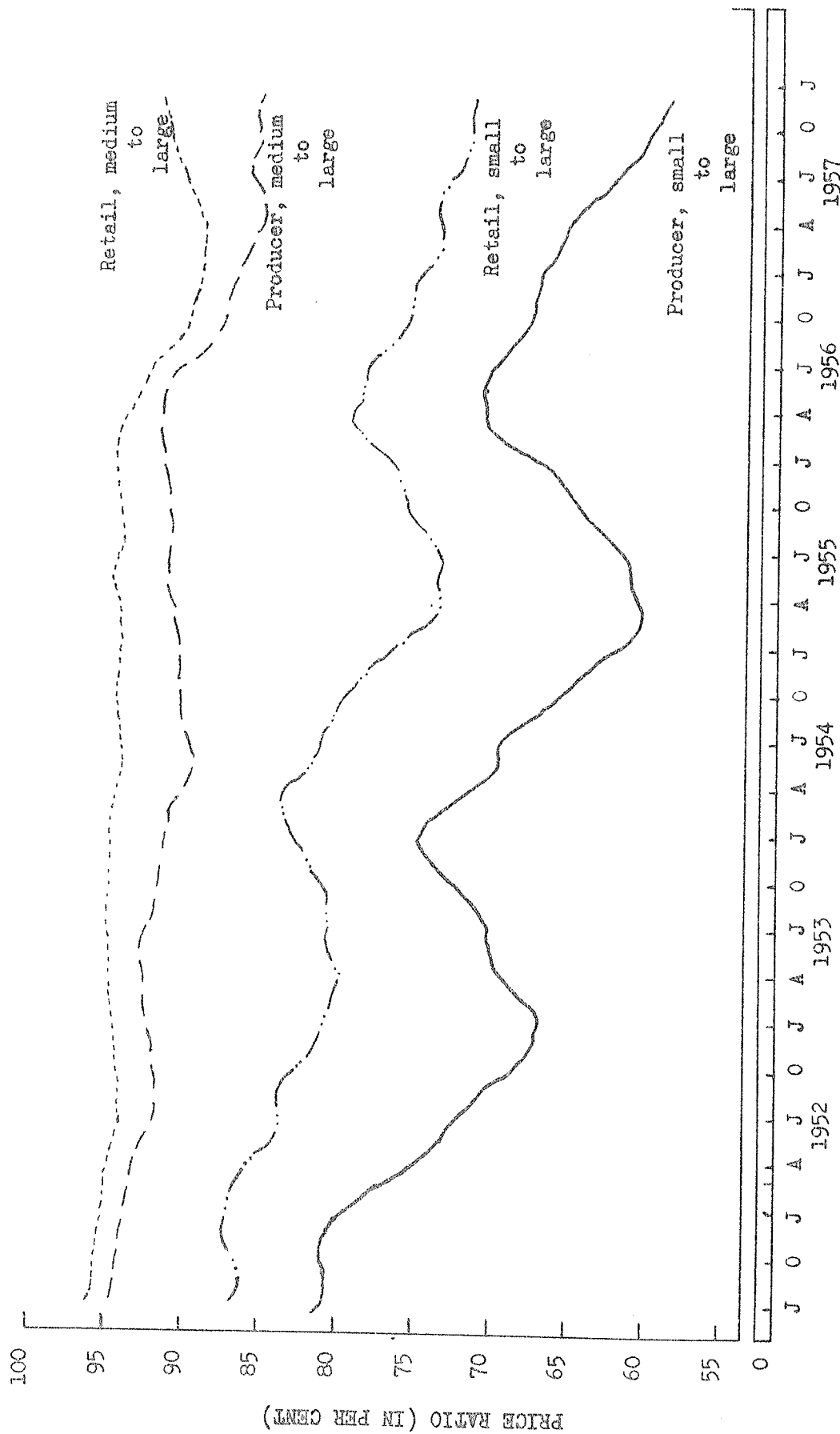
FIGURE 7
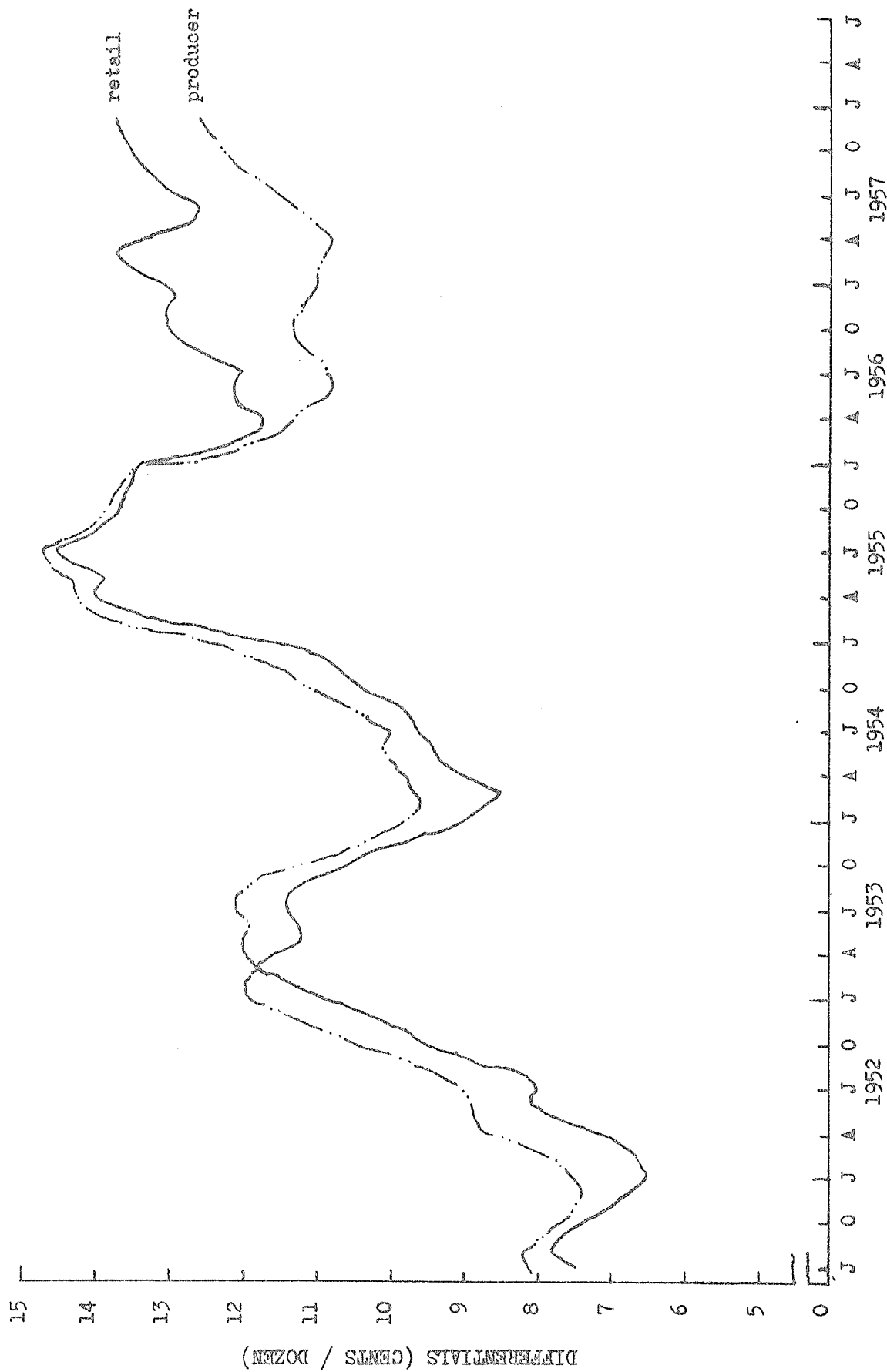
MOVING AVERAGE, RETAIL AND PRODUCER PRICE DIFFERENTIALS, A-SMALL - A-LARGE, WINNIPEG, 1952-1957
(Source: Based on data from Poultry Products Market Review, 1952-1957)

Relative Supply

The supply of A-medium eggs relative to the supply of A-large eggs generally varies from a seasonal peak in October at 261 per cent of the annual average to a seasonal low of 43 per cent of the annual average in June. The seasonal index indicates that the supply of medium eggs relative to the supply of large eggs is greatest in the fall and early winter months, September to December and lowest in the spring and early summer months, April to June. The seasonality of the supply of Grade A-small eggs is very pronounced. The supply of small Grade A eggs relative to the supply of large Grade A eggs climbs to a seasonal peak of 409 per cent of the yearly average in October then declines in April to a seasonal low of 7 per cent of the yearly average. In the months August to November the supply of small eggs relative to the supply of large eggs is substantially above average, but drops to less than 10 per cent of the yearly average in the months of March, April and May. The index of seasonal variation for the relative supplies of large, medium, and small Grade A eggs is shown in Table VIII.

The seasonal pattern in the price ratios is closely related to the seasonal pattern in the production of the different sizes of Grade A eggs. The prices of A-medium eggs relative to the prices of A-large eggs are negatively

or inversely correlated with the supply of A-medium eggs relative to the supply of A-large eggs at both the retail and producer levels of the marketing system.[1] A negative correlation implies that the price ratios of A-medium to A-large eggs are high when the supply of medium eggs relative to the supply of A-large eggs is low. Conversely the price ratio of A-medium to A-large eggs is low when the quantity ratio is high. The coefficient of correlation between the A-medium/A-large producer price ratios and the A-medium/A-large quantity ratios is minus .755. The coefficient of correlation is significant at the 1 per cent level. The coefficient of determination is .569. Approximately 57 per cent of the variation in the A-medium/A-large producer price ratios is associated with variation in the supply of A-medium eggs relative to the supply of A-large eggs.

When January and February 1957 are omitted from the analysis (a change in Government price support program from deferred offer to purchase to direct offer to purchase had recently come into effect) a much higher coefficient of correlation between the A-medium/A-large producer price ratios and the supply ratios of A-medium to A-large eggs is

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[1]Coefficients of correlation are based on linear regression estimates.

obtained. The coefficient of correlation is - .847 and is significant at the 1 per cent level. The coefficient of determination is .717. This indicates that 71.7 per cent of the variance in the A-medium/A-large producer price ratios is now associated with the relative supply of A-medium to A-large eggs. Since this leaves approximately 28 per cent of the variance to be accounted for by all other factors, it appears that the supply of A-medium eggs relative to the supply of A-large eggs is the most important factor which is associated with the prices paid to producers for A-medium eggs relative to the prices paid to producers for A-large eggs.

The largest coefficient of correlation between the A-medium/A-large retail price ratios and the A-medium/A-large supply ratios is obtained when the supply variable, that is, the ratio of the supply of A-medium to A-large eggs, is lagged by one month. The coefficient of correlation is - .825. The coefficient of correlation is significant at the one per cent level. The coefficient of determination is .681. In other words, 68.1 per cent of the variance in the retail price ratios of A-medium to A-large eggs is explained by the variance in the A-medium/A-large supply ratios for eggs. The association between the retail price ratios and the supply ratios of A-medium to A-large eggs is such that when the price ratios are high the supply ratios are low,

or when the price ratios are low the supply ratios are high.
The association is not direct but lagged in that the A-medium/
A-large retail price ratio for February is inversely corre-
lated with the A-medium/A-large quantity ratio in the
previous month.

TABLE VIII

INDEX OF SEASONAL VARIATION, SUPPLY RATIOS
A-MEDIUM — A-LARGE, A-SMALL — A-LARGE,
MANITOBA 1952-1957*

MONTH	A-MEDIUM — A-LARGE	A-SMALL — A-LARGE
January	90	27
February	63	13
March	48	8
April	44	7
May	44	9
June	43	12
July	49	28
August	70	110
September	143	347
October	261	409
November	212	170
December	133	60

*Based on data from The Poultry Products Market
Review, 1952 to 1957.

The A-small/A-large price ratios for eggs are
negatively or inversely correlated with the A-small/A-large
quantity ratios. The coefficients of correlation are much
smaller than those obtained when the A-medium/A-large price
ratios were correlated with the A-medium/A-large supply

ratios of eggs. The coefficient of correlation between the A-small/A-large producer price ratios and the supply ratios of A-small to A-large eggs is - .672 and it is significant at the 1 per cent level. Approximately 45 per cent of the variation in A-small/A-large producer price ratios is associated with the variation in A-small/A-large supply ratios of eggs. The coefficient of determination is .452. The coefficient of correlation between the retail price ratios and the supply ratios of A-small to A-large eggs is - .630 and is significant at the 1 per cent level. The coefficient of determination is .397 which indicates that only 39.7 per cent of the variance in the retail price ratios of small to large Grade A eggs are explainable by the variance in the supply ratios of A-small to A-large eggs.

Total Supply

The Prairie Provinces have been an area of surplus production throughout the period 1949-1958. There has been a regional surplus in the sense that production has exceeded consumption within this area. The production data are obtained from Dominion Bureau of Statistics reports of total egg production, minus a breakage allowance and an estimate of eggs used for hatching. The figures thus represent the production of eggs in each area for use as food.

The consumption data have been calculated by taking the
D.B.S. estimates of the average per capita consumption of
eggs in Canada as a whole and assuming that this national
per capita average is applicable to the population in each
province. At present this appears to be the best means of
estimating egg consumption in any province or group of
provinces, since figures are not available on the total
interprovincial movements of eggs.[2]

The twelve month moving average of total egg supply
in Manitoba for 1952 to 1957 indicates that total egg
supply has been increasing in this province. This is shown
in Figure 8. The economic consequence of surplus production
is a declining price level for eggs in Manitoba assuming no
available markets outside the province for the surplus
production.[3] Total supply affects the price ratios
indirectly through falling price levels when associated with
fixed or increasing differentials in absolute terms.

Price ratios of large, medium and small Grade A eggs

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[2]Poultry Products Market Report "Egg Production and
Consumption, by Regions," No. 10, March 4, 1960.

[3]Op. cit. The Prairie Provinces have been an area
of surplus throughout the whole of the 1949-1958 period,
while Quebec and Ontario have represented a deficit area
in all years except 1949. In all years the Prairie
surplus was greater than the Central Canada deficit.

are negatively or inversely correlated with total supply.
In other words, the price ratios tend to be high when the
total supply is low, or in the opposite situation price
ratios tend to be low when the total supply is large. The
coefficient of correlation between the moving average of
producer price ratios of A-medium to A-large eggs and the
moving average of total production is - .504. The
correlation coefficient is significant at the 1 per cent
level. The coefficient of determination is .254 indicating
that 25.4 per cent of the variance in the producer price
ratio of A-medium to A-large eggs is accounted for by the
variation in total egg production.

A somewhat higher coefficient of correlation is
obtained between the moving average of retail price ratios
of medium to large Grade A eggs and total production than
with producer price ratios. The coefficient of correlation
between the A-medium/A-large retail price ratio and total
production is - .553. The coefficient of correlation is
significant at the 1 per cent level. The coefficient of
determination is .306 which indicates that 30.6 per cent
of the variance in the retail price ratio of A-medium to
A-large eggs is explained by the variance in total supply.
Very low coefficients of correlation are obtained for the
moving average of A-small to A-large price ratios and total
supply. The correlation coefficient for the A-small/A-large

producer price ratios and total supply is minus .08, while
the coefficient of correlation between the moving average
of A-small/A-large retail price ratio and total supply is
minus .174.

Total production of eggs in Manitoba has been increas-
ing. Total production has not only been increasing but the
excess over consumption has also been increasing. The effect
of surplus production is declining egg prices. Figures 6 and
7 have indicated that the price differentials between medium
and large, and small and large Grade A eggs at both retail
and producer levels show an upward trend between 1952 and
1957. With falling egg prices, the increasing price differ-
entials between A-medium and A-large eggs and A-small and
A-large eggs are reflected as more steeply falling price
ratios.

The full effect of over-production on prices is
cushioned by the Canadian Government Price Support Programme,
therefore no attempt is made to determine, in quantitative
terms, the indirect effect of total supply on the price ratios.

Fixed differentials and falling prices for A grade
eggs are expressed by declining price ratios. For example
a spread of 8 cents between the prices of medium to large
Grade A eggs with the price of A-large eggs set at 48 cents
results in a medium to large price ratio of 40/48 or 83.3
per cent. With the same differential and the price of A-large

now set at 40 cents, the A-medium/A-large price ratio is 32/40 or 80 per cent.

Falling price ratios represent another form of expressing increasing price differentials between the sizes of Grade A eggs. With falling prices levels, increasing price differentials resulted in greater percentage declines in the price ratios.

In the description of the price ratios the downward trend in the producer price ratios is more pronounced than the downward trend in the retail price ratios. This suggest that some other variable is involved. A logical reason for the more pronounced downward trend in the producer price ratios than in the retail price ratios lies in the existence of fixed margins or margins with both fixed and percentage elements. It is therefore necessary to examine the marketing margins between the retail and producer levels.

Marketing Margins

An examination of the marketing margins for Grade A eggs shows that the marketing margin is neither fixed in absolute terms nor in absolute percentages. The per unit marketing charges for Grade A eggs are a combination of both fixed and percentage elements. The per unit marketing charges are shown in Appendix Table XI. A twelve month centred moving average passed through the per unit marketing charges between

the retail and producer levels of the marketing system shows
no appreciable trend in the per unit marketing charges for
A-large and A-medium eggs. A very slight downward trend is
perceptible in the per unit marketing charges for A-small
eggs. Figure 9 shows the moving averages of the per unit
marketing charges for A grade eggs.

The per unit marketing charges for A-large eggs
average 18.5 cents per dozen. The per unit marketing charges
between the retail and wholesale levels average 5.9 cents
per dozen, while the average between the wholesale and
producer levels is 12.6 cents per dozen. For A-medium eggs,
the per unit marketing charges average 5.9 cents between
retail and wholesale levels, and 12.5 cents per dozen between
wholesale and producer levels. The total per unit marketing
charges for A-medium eggs approximate 18.4 cents per dozen.
The average per unit marketing charges for A-small eggs is
18.4 cents per dozen which is divided into 5.6 cents as the
retail margin and 12.8 cents per dozen as the wholesale margin.

An analysis of variance shows that at the one per
cent level there is no significant difference between the
average per unit marketing charges for large, medium and
small Grade A eggs. The inference drawn is that there are no
appreciable differences in the cost incurred in handling
the different sizes of eggs.

The effect of relatively fixed per unit marketing
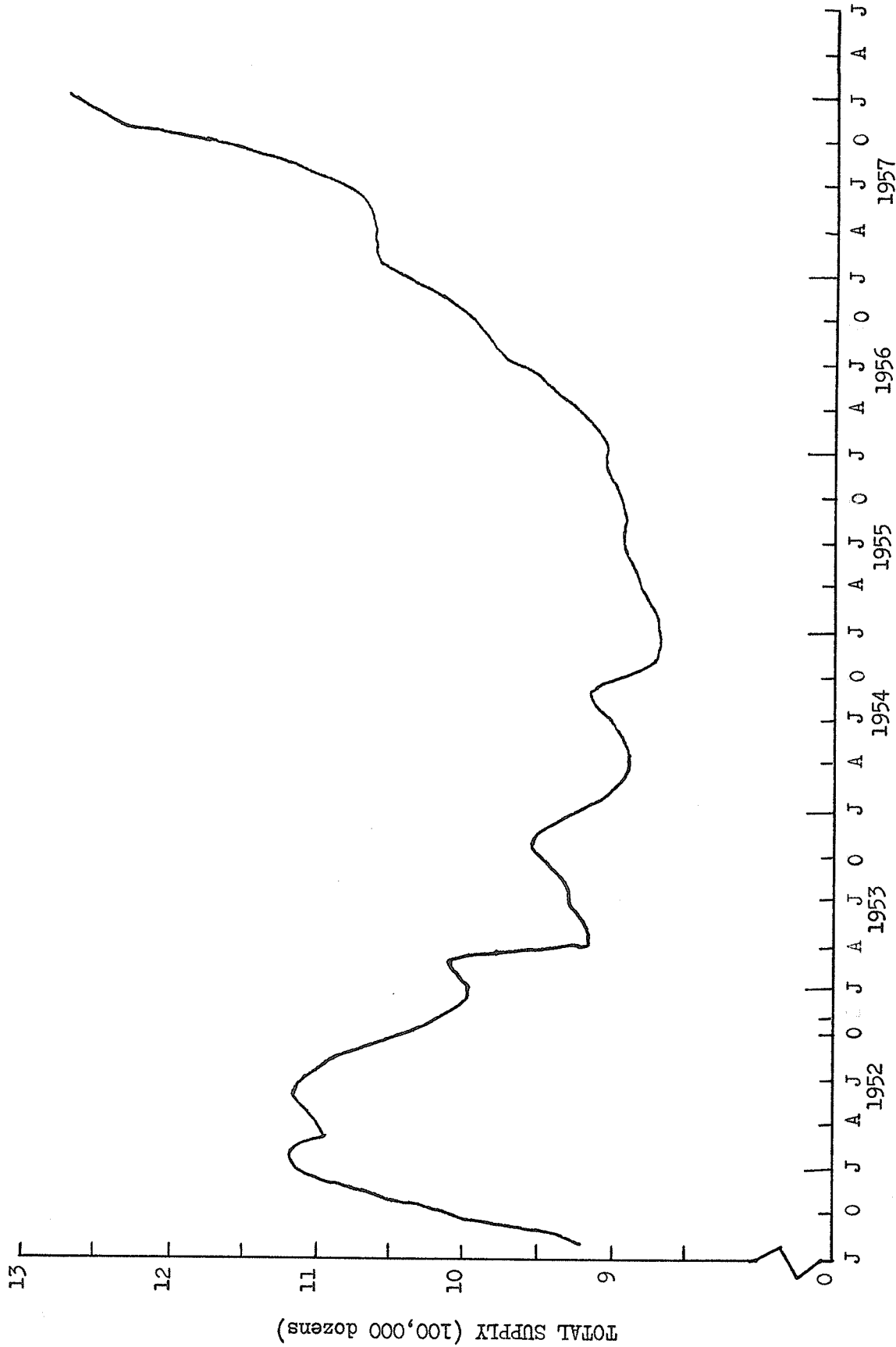
FIGURE 8

MOVING AVERAGE OF TOTAL SUPPLY, MANITOBA,
1952 - 1957

(Source: Poultry Products Market Review 1952-1957)

80

charges between retail and producer levels for large, medium, and small eggs on producer price ratios is such that the producer price ratios are always lower than the corresponding retail price ratios. Relatively fixed per unit marketing charges or flat margins alter the price ratios by exerting at the producer level a downward presure on the producer price ratios.

The downward pressure of flat margins or relatively fixed per unit marketing charges on producer price ratios becomes effective when associated with falling price levels for A-large eggs. The effect is accentuated by increasing price differentials between A-large and A-medium or A-large and A-small eggs. Per unit marketing charges of approximately the same magnitude for the different sizes of eggs and which contain both fixed and percentage elements induce a more rapid decline in the producer price ratios, more so in the A-small/A-large price ratios than in the A-medium/A-large price ratios. The combination of relatively fixed per unit marketing charges, falling price levels for eggs, and increasing price differentials between A-large and A-medium and A-large and A-small eggs at both retail and producer levels accounts for the more pronounced downward trend in the producer price ratios.

Interpretation of Findings.

This study shows that in Manitoba the differences
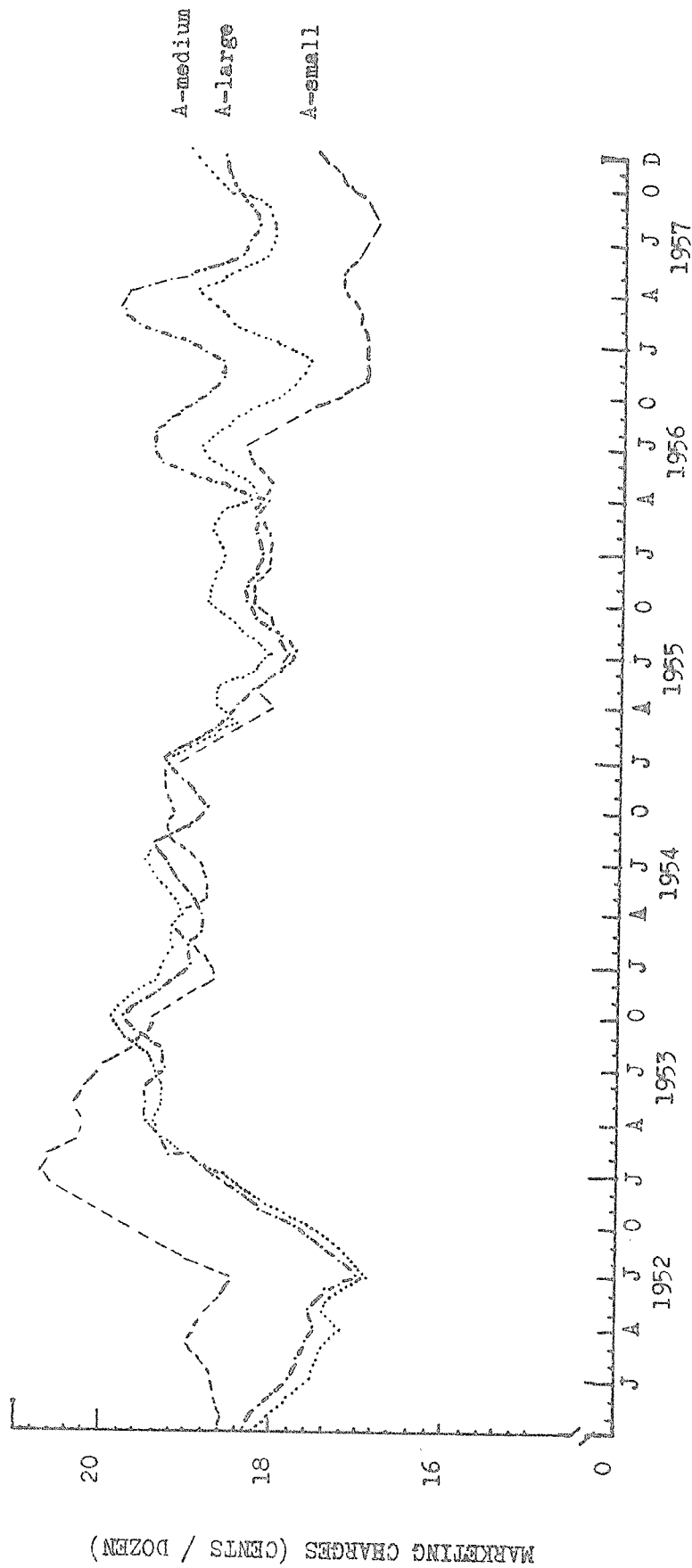
FIGURE 9

MOVING AVERAGE A-LARGE, A-MEDIUM, A-SMALL PER UNIT
MARKETING CHARGES, WINNIPEG, 1952-1957
(Source: Appendix Table XI)

between A-medium and A-large eggs, and A-small and A-large eggs, at both retail and producer levels, have been increasing during the period 1952 to 1957. In Manitoba, the level of prices has been increasing for the period under study. With other things remaining unchanged, falling egg prices constitute increases in real income. The increasing price differentials at the retail level suggest that either consumers are becoming more irrational with regards to egg purchases or that they are unaware of the magnitude of the differences between the sizes of A grade eggs. It is possible that with lower egg prices some consumers do not seriously consider purchasing medium or small eggs, particularly if their decision to purchase eggs is based on absolute total expenditure on eggs.

The degree of correlation between the price ratios and the quantity ratios of the three sizes of A grade eggs indicates that large, medium and small eggs are not perfect substitutes for each other. Coefficients of determination of .681 at retail, and .717 at the producer level between the A-medium/A-large price ratios and the A-medium/A-large quantity ratios show that there is some degree of substitutability between medium and large eggs. On the other hand, the low coefficients of determination between the A-small/A-large price and quantity ratios imply that there is little substitution of small eggs for large eggs. The

lesser degree of substitution between A-small and A-large
eggs than between A-medium and A-large eggs reflects either
the effects of the subjective factors associated with
the discontinuity of egg sizes or that consumers are
unaware or choose to ignore the magnitude of the differences
of food content in the sizes of A grade eggs. For many
months of the year small eggs are not available in many
retail outlets. The effects of consumer ignorance or of
indifference or of the subjective forces are, therefore,
reinforced by the irregular flow of small eggs to market.

CHAPTER V

SUMMARY AND CONCLUSIONS

An attempt is made to examine the nature of the price differentials between large, medium and small Grade A eggs in Manitoba for the period 1952 to 1957, and to determine the factors and the degree to which these factors affect the price differentials.

The hypothesis is put forward that the prices for large, medium and small Grade A eggs, at the producer level, do not adequately reflect the grade attributes. On the basis of differences in weight, and using large eggs as the base, A-medium eggs tend to be overvalued relative to A-large eggs. A-small eggs, however, tend to be more heavily discounted than is justified by differences in weight between small and large Grade A eggs.

The theoretical concept of the perfect market is used as the standard from which imperfections in prices are measured. This standard provides a measure from which to judge the adequacy of prices to reflect grade attributes for Grade A eggs. The perfect market results in a uniform price for a "commodity" plus or minus appropriate price differentials for different classes and grades within that commodity. A constant percentage relationship prevails between egg weight and edible matter content of the shell egg, so that A-medium

eggs contain 88 per cent and A-small eggs 76 per cent of
the food material available in A-large eggs. Since Grade A
eggs are homogeneous in terms of quality, on the basis of
weight the appropriate differentials between large, medium,
and small Grade A eggs are for A-medium eggs to be valued at
88 per cent and A-small eggs to be valued at 76 per cent of
A-large eggs.

The basic assumption in this study is that large,
medium and small Grade A eggs are regarded as perfect
substitutes for each other by the final consumer. This
assumption is open to question as an egg is a unit not
easily divisible into smaller portions. There are subjective
factors associated with the discontinuity in egg size which
further suggest that large, medium and small eggs are not
perfect substitutes for each other. The consumer may
associate the purchase of small eggs with financial hard-
ships or may feel obligated to serve two small eggs for one
large egg. If the decision to purchase eggs is based on
absolute expenditure, then even though the relative value of
small eggs is the same as large eggs, the expenditure on two
small eggs is greater than the expenditure on one large egg.
One possible result is that small eggs will be heavily
discounted before their purchases are even considered.

The hypothesis put forward is verified. At the retail
level relative to A-large eggs, A-medium eggs are valued at

5 per cent above the theoretically appropriate level. A comparison, of actual to hypothetical producer price ratios for A-medium to A-large eggs, indicates that the prices of A-medium eggs relative to the prices of A-large eggs are 2 per cent above the theoretical level, or that A-medium eggs are overvalued to the extent of 2 per cent of the value of A-large eggs. At the retail level, the prices of A-small eggs relative to the prices of A-large eggs average 3 per cent above the theoretical level. In other words, at retail, A-small eggs in terms of A-large eggs, are overvalued to the extent of 3 per cent. The producer price ratios of A-small to A-large eggs are approximately 8 per cent lower than the theoretical price ratios. The prices paid to producers for A-small eggs, relative to the prices paid to producers for A-large eggs, are discounted far in excess of that which is justified on the basis of differences in weight between small and large Grade A eggs.

Before any suggestions can be made to improve the efficiency of the pricing system for Grade A eggs, the factors which affect the price differentials must be determined. By far the most important factor associated with variations in the price ratios, at both producer and retail levels, is the supply ratio of large and medium and large and small Grade A eggs. An analysis of price differentials shows that approximately 72 per cent of the variation in the

A-medium to A-large producer price ratios is accounted for
by the variation in the quantity ratios of A-medium to
A-large eggs. Approximately 68 per cent of the variation in
the AM/AL retail price ratios for eggs is explained by the
variance in the AM/AL supply ratios for eggs lagged by one
month.

A much smaller percentage of the variation in the
A-small to A-large price ratios at both retail and producer
levels is accounted for by the variation in the A-small to
A-large supply ratios for eggs. Approximately 45 per cent
of the variation in the AS/AL producer price ratios is
explained by the variation in the supply ratios of AS/AL eggs.
Only 40 per cent of the variation in the AS/AL retail price
ratios is accounted for by the variation in the AS/AL supply
ratios for eggs.

The degree of correlation between the quantity ratios
and the price ratios bear out the thesis that large, medium
and small eggs are not perfect substitutes for each other.
The higher degree of association observed between AM/AL
price and quantity ratios than between AS/AL price and quantity
ratios imply that there is greater substitution between
large and medium eggs than between large and small eggs.
The lack of substitution between large and small eggs
indicates to some extent the influence of subjective factors
associated with discontinuity of egg size.

Another important factor which affects both retail and producer price ratios of medium to large Grade A eggs is total supply. Approximately 25 per cent of the variation in the AM/AL producer price ratios for eggs is associated with the variation in the total supply of eggs. For the AM/AL retail price ratios for eggs, approximately 31 per cent of the variation is accounted for by variation in total supply. The effect of total supply on both retail and producer price ratios of A-small to A-large eggs is negligible. The coefficient of determination between the retail price ratios of A-small to A-large and the total supply of eggs is .030. The coefficient of determination between the producer price ratios of A-small to A-large eggs and total supply is .006. The supply of A-small eggs is highly variable, so variable that for several months of the year A-small eggs are not available at many retail outlets. This extreme variability of supply may be in part responsible for the low coefficients found for the A-small to A-large price ratios.

Both the quantity ratios of Grade A eggs and the total supply of eggs are negatively correlated with the price ratios of Grade A eggs at both the retail and producer levels of the marketing system. A negative correlation implies that when the price ratios are high both the quantity ratios and the total supply of eggs are low. Buyers tend to pay

more for A-small, but especially for A-medium eggs when the
supply of A-small eggs and the supply of A-medium eggs are
short relative to the supply of A-large eggs. When the supply
of A-small eggs is large relative to the supply of A-large eggs
producers receive considerably less than the relative value
of A-small eggs. Buyers have a tendency to pay relatively
more for A-medium eggs at both producer and retail levels
when eggs are in relatively short supply.

In the absence of any detailed analysis of consumer
preferences, of merchandizing practices, and of retail pricing
of eggs, no definite conclusions are drawn for consumer pre-
ferences for large, medium, and small eggs. Contrary to
expectations, the prices of A-small eggs and the prices of
A-medium eggs are not a constant proportion of the prices of
A-large eggs. Given homogeneity of quality, size or food con-
tent is, therefore, not the only important consideration in the
purchase of eggs. On the basis of increasing price differentials
at retail, it is fair to conclude that either buyers are irrat-
ional in their purchases of eggs or have strong preferences or
that they are unaware of the real magnitude of the differences
in food content between large and small, or large and medium
eggs. The negative correlation between the quantity ratios
and the price ratios, and between total supply and the
price ratios, together with the magnitude of the
coefficient of determination leads to the conclusion that

any action or programme, which affects the relative supplies
of Grade A eggs, for example, the support and storage of A-
large eggs in periods of over production, adversely influences
the prices of A-medium eggs and of A-small eggs relative to
the prices of A-large eggs at the producer level. These effects
more than offset the effects of shorter supply.

Total supply has not only been increasing but has been
increasing faster than consumption. The inevitable economic
consequence of overproduction is falling price levels for
eggs. The differentials between the prices of large and
medium and large and small Grade A eggs show an upward
trend. The price ratios for large, medium, and small Grade
A eggs are declining. The per unit marketing charges between
retail and producer levels are of approximately the same
magnitude for the three sizes of Grade A eggs. The per unit
marketing charges contain both fixed and percentage elements.

The downward trend in the retail price ratios is an
expression of increasing price differentials between large
and medium and large and small Grade A eggs, associated
with falling price levels for eggs in Manitoba. The down-
ward trend in the producer price ratios is more pronounced
so that increasing price differentials associated with
falling price levels for eggs only provide a partial answer.
The existence of per unit marketing charges of approximately
the same magnitude for the three sizes of Grade A eggs,

together with falling price levels for eggs, and increasing price differentials between large, medium, and small Grade A eggs is a much more adequate explanation for the marked decline in the producer price ratios, especially the A-small to A-large price ratios. The use of percentage margins results in less distortion of the producer price ratios.

Large, medium and small eggs are of the nature of joint products so that the burden of adjustments lies not with producers but with the marketing system. More research is, therefore, needed in the area of consumer preferences for eggs. Research is also needed to assess retail pricing and merchandizing practices and to examine the nature and composition of the marketing margins for eggs.

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APPENDIX

APPENDIX A

ABSTRACT FROM REGULATIONS RESPECTING THE
GRADING PACKING AND MARKING OF EGGS

Canadian Egg Standards

1. (1) The Canadian Egg Standards are based upon the requirements of the Act and regulations and when they are applied to eggs shipped, transported, offered or had in possession for sale, purchased or sold, compliance with the regulations shall be obligatory with respect to

       (a) grades;
       (b) grading premises and equipments;
       (c) packing materials;
       (d) grade markings.

(2) The name of a Canadian Standard Egg Grade applied on any container of eggs shall constitute a representation that the eggs therein have been graded, packed and marked in accordance with the Canadian Egg Standards.

Canadian Standard Egg Grades

2. (1) The Canadian Standard Egg Grades shall comprise compulsory and optional grades as follows;

Compulsory Grades	Optional Grades
Grade A Large Size	Grade A Extra Large Size
Grade A Medium Size	
Grade B	
Grade C	Grade A Small Size
	Grade A Peewee Size
Cracks	
	Grade Al Extra Large Size
	Grade Al Large Size
	Grade Al Medium Size
	Grade Al Small Size

(2) Each egg shall be placed in the highest compulsory or corresponding optional grade for which it qualifies and any egg not so placed shall be deemed not to have been properly graded according to the Canadian Egg Standards.

(3) In grading eggs, consideration shall be given to the three following factors:

      (a) quality factor, as determined by candling;

      (b) weight factor;

      (c) shell factor, as determined by degree of cleanness and by soundness and construction of shell.

3. (1) All eggs bearing the grade designation "A" shall comply with the following specifications:

(a) quality factor – yolk outline indistinct; yolk round in shape and reasonably centred, showing no germ development or readily visible defects or abnormal conditions; air cell shall not exceed 3/16 inch in depth; floating air cells, blood spots and meat spots are not permitted.

(b) shell factor – shell shall be unbroken and practically normal in shape; slightly ridged or rough areas or slightly misshapen shells are permitted, but definitely misshapen, heavily ridged or thin shells prohibited; the shell shall be clean, but may show three stain spots, none of which shall exceed an area of 1/8 x 1/16 inches.

(c) weight factor – Grade A Extra Large Size shall weigh individually at the rate of 27 ounces per dozen or over.

Grade A Large Size shall weigh individually at the rate of 24 ounces per dozen or over.

Grade A Medium Size shall weigh individually at the rate of 21 ounces per dozen and up to but not including 24 ounces per dozen.

Grade A Small Size shall weigh individually at the rate of 18 ounces per dozen and up to but not including 21 ounces per dozen.

Grade A Peewee Size shall weigh individually at the rate of less than 18 ounces per dozen.

4. All eggs eligible for the Canadian Standard Egg Grades that are smaller in size or lower in quality factor or shell factor than the grade marked on the container shall be considered to be undergrades.

5. At point of grading or inspection eggs shall be considered to be misbranded if they contain more than eight under grade eggs in fifteen dozen, and at any point other than that of grading or inspection if they contain more than twelve undergrade eggs in fifteen dozen, except that

(a) eggs which are, for size or for shell soiling, not more than one grade below that marked shall be counted as undergrades only to the extent that they are each in excess of four in fifteen dozen; and

(b) cracked eggs only in excess of six in fifteen dozen shall be counted as undergrades after delivery.

6. (1) With respect to the quality factor, the seller shall be deemed to have misbranded any eggs, which, within thirty-six hours after delivery by him, are found to be below the grade stated on the container at the time of delivery and, with respect to the factors of weight and appearance, he shall be deemed to have misbranded any eggs which are found, within seven days after delivery by him, to be below the grade stated on the container at time of delivery.

(2) After the expiration of the period specified in subsection (1) the responsibility for eggs found to be below the grade designated on the container shall rest on the person in whose possession such eggs are found.

"Act" means the Live Stock and Live Stock Products Act.

APPENDIX B

SUMMARY OF MARGINAL CONDITIONS

The seven marginal conditions of maximum welfare are;

1. The marginal rate of substitution between any two products must be the same for every individual who consumes both.

2. The marginal rate of transformation between any two products must be the same for any two firms that produce both.

3. The marginal rate of transformation between any factor and any product must be the same for any pair of firms using the factor and producing the product.

4. The marginal technical rate of substitution between any pair of factors must be the same for any two firms using both to produce the same product.

5. The marginal rate of substitution between any pair of products for any person consuming both must be the same as the marginal rate of transformation (for the Community) between them.

6. The marginal rate of substitution between the amount of (product) X received for aiding in its production (by a given firm) and the time spent in rendering this aid must be the same for each factor unit owner as the marginal rate of transformation between the time of his factor unit spent in aiding production (in this way) and (the product) X.

7. The marginal rate of substitution between resource control at any pair of moments (t_i and t_j) must be the same for every pair of individuals or firms (including pairs, one member of which is a firm and the other an individual).[1]

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[1]Reder, M.W., Studies in the Theory of Welfare Economics, Columbia University Press, New York, 1946, p. 35.

TABLE IX

RETAIL PRICES IN CENTS PER DOZEN, GRADE A
EGGS, WINNIPEG, 1951-1957*

YEAR	SIZE	J	F	M	A	M	J	J	A	S	O	N	D
	A-LARGE	55	49	55	57	64	68	73	76	78	76	68	66
1951	A-MEDIUM	53	47	53	55	62	66	71	74	76	74	62	63
	A-SMALL	50	44	47	50	56	60	64	68	69	65	55	56
	A-LARGE	49	46	44	44	44	46	50	60	60	62	68	52
1952	A-MEDIUM	44	44	42	42	42	44	48	58	58	58	60	47
	A-SMALL	41	38	41	40	41	40	44	48	50	45	45	44
	A-LARGE	50	48	55	60	61	61	73	76	75	79	59	54
1953	A-MEDIUM	46	46	53	58	59	59	71	74	73	74	53	49
	A-SMALL	42	41	45	47	52	52	58	60	60	55	48	43
	A-LARGE	50	54	56	49	46	46	54	61	58	61	61	48
1954	A-MEDIUM	48	50	53	47	44	45	52	59	56	54	53	45
	A-SMALL	43	44	48	43	41	43	48	49	47	37	39	39
	A-LARGE	48	46	46	50	50	51	60	64	68	68	66	63
1955	A-MEDIUM	46	44	44	47	48	49	58	62	65	65	58	55
	A-SMALL	37	36	36	39	40	40	43	43	44	44	46	45
	A-LARGE	55	50	50	56	56	56	60	66	66	66	67	50
1956	A-MEDIUM	52	48	48	54	54	55	57	64	59	56	56	42
	A-SMALL	47	44	44	46	46	46	42	55	45	40	41	38
	A-LARGE	50	47	45	46	46	46	58	60	60	56	50	49
1957	A-MEDIUM	42	37	42	43	43	43	56	57	53	50	44	43
	A-SMALL	38	35	35	36	37	37	44	44	41	36	32	33

*Based on data from the Poultry Products Market Report,
1951 to 1957.

TABLE X

PRODUCER PRICES IN CENTS PER DOZEN, GRADE A EGGS, WINNIPEG, 1951-1957 **

YEAR	SIZE	J	F	M	A	M	J	J	A	S	O	N	D
	A-LARGE	36	35	43	42	48	50	56	57	58	53	54	35
1951	A-MEDIUM	34	33	41	40	46	48	54	55	56	48	49	33
	A-SMALL	32	29	34	34	40	43	46	46	47	39	39	29
	A-LARGE	31	32	30	29	30	30	36	41	41	44*	42*	32
1952	A-MEDIUM	29	30	28	27	28	28	34	39	39	37	35	29
	A-SMALL	26	26	25	24	24	23	25	25	25	24	27	23
	A-LARGE	30	32	38	40	42	43	55	52	55*	57	40*	33*
1953	A-MEDIUM	28	30	36	38	40	41	53	50	51	51	32	29
	A-SMALL	22	23	24	28	30	31	39	39	39	37	27	24
	A-LARGE	34*	35	32*	31	31	31	38	38*	41*	42*	40	24
1954	A-MEDIUM	30	32	30	29	29	29	36	36	34	34	32	22
	A-SMALL	25	28	26	25	25	25	25	25	20	20	22	19
	A-LARGE	30	30	30	31	32	36*	45	49*	50*	49*	47	41*
1955	A-MEDIUM	28	28	28	29	30	34	43	46	44	41	39	37
	A-SMALL	19	18	20	21	22	23	23	25	27	24	29	30
	A-LARGE	36	31*	32	37*	38	44*	43	49	47	47	34	30
1956	A-MEDIUM	33	29	30	35	36	42	42	47	41	38	28	24
	A-SMALL	28	24	24	28	30	33	32	36	27	23	22	20
	A-LARGE	30	30	30	30	30	30	32	38*	40	40	31	30
1957	A-MEDIUM	22	25	27	28	27	27	30	34	32	30	26	26
	A-SMALL	20	20	20	22	22	22	22	24	22	16	16	16

**Source: Poultry Products Market Review, 1951 to 1957.

* Adjustments based on the average of weekly prices (four weeks) from the Poultry Products Market Report, 1951 to 1957.

TABLE XI

PER UNIT MARKETING CHARGES IN CENTS PER DOZEN,
GRADE A EGGS, WINNIPEG, 1951-1957*

YEAR	SIZE	J	F	M	A	M	J	J	A	S	O	N	D
	A-LARGE	19	14	12	15	16	18	17	19	20	23	14	31
1951	A-MEDIUM	19	14	12	15	16	18	17	19	20	26	13	30
	A-SMALL	18	15	13	16	16	17	18	22	22	26	16	27
	A-LARGE	18	14	14	15	14	16	14	19	19	20	20	20
1952	A-MEDIUM	15	14	14	15	14	16	14	19	19	21	22	18
	A-SMALL	15	12	16	16	17	17	19	23	25	21	19	20
	A-LARGE	20	16	17	20	19	18	18	24	21	21	20	19
1953	A-MEDIUM	18	16	17	20	19	18	18	24	21	22	20	19
	A-SMALL	20	18	21	19	22	21	19	21	21	22	19	18
	A-LARGE	17	19	22	18	15	15	16	25	19	22	21	24
1954	A-MEDIUM	19	19	21	18	15	16	16	25	19	23	21	23
	A-SMALL	18	13	20	18	16	18	23	24	22	18	17	20
	A-LARGE	18	16	16	19	18	18	15	17	19	20	19	18
1955	A-MEDIUM	18	16	16	18	18	18	15	17	20	25	19	17
	A-SMALL	18	19	17	18	18	17	20	18	16	21	17	15
	A-LARGE	19	20	18	20	18	14	17	17	19	19	33	20
1956	A-MEDIUM	19	20	18	20	18	15	17	17	18	18	28	18
	A-SMALL	19	20	20	19	16	16	20	19	18	17	19	18
	A-LARGE	20	17	15	16	16	16	26	21	20	16	19	19
1957	A-MEDIUM	20	15	15	15	16	16	26	19	21	20	18	17
	A-SMALL	18	15	15	14	15	15	22	19	19	20	16	17

*Calculations based on Tables IX and X.