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STOCHASTIC DOMINANCE AS A DECISION TECHNIQUE FOR RANKING INVESTMENTS

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ABSTRACT

This paper introduces the importance of stochastic dominance approach in decision making. Also, it explores the derivation of the various degrees of stochastic dominance ranking rules by integrating the expected utility functions of the two choice rules alternatives. The stochastic dominance ranking model is a technique for ranking investments that avoids many of the assumptions required by other popular ranking models. It also shows how stochastic dominance test can be implemented. Finally, stochastic dominance model is applied to show that small stock returns dominant low-grade bond returns.

INTRODUCTION

Decision-making is as old as the human race and, indeed, some might distinguish people from other creatures by their ability to introspect on their preferences and make choices in decision problems. The study of decision-making both as a phenomenon of empirical interest and as a deductive science is centuries, and perhaps, millennia, old.

By definition, a decision involves a choice among alternative courses of action offering consequences. To make a choice, the decision-maker must apply some criterion or valuation principle to the consequence. Having selected the best course of action, the decision-maker implements the action and the decision becomes historical.

Decision-making is an ongoing and virtually continuous activity. It determines the nature of our existence and is unavoidable. Even indecision is implicit decision–making, for choosing to do nothing is a choice to continue one's present course of action. Given the significance of decision problem so the phenomenon can be studied scientifically both from descriptive and normative viewpoints.

This research is concerned with one methodological segment of decision theory. This theory has been called dominance criteria, or more precisely, stochastic dominance criteria. Stochastic dominance (SD) is a condition that may exist between two mutually exclusive investment alternatives; all individuals with defined qualitative wealth preferences would choose one alternative over the other. The preferences are qualitative rather than quantitative, because only ordinal concepts are involved. Also, SD is a technique for ranking investments that avoids many of the assumptions required by other popular ranking methods. For example, the widely used mean variance approach requires either the assumption of quadratic utility functions on the part of investors or normal distribution of security returns for accuracy of rankings. By avoiding these restrictive assumptions, the SD technique should be more applicable than alternative models. The individual prefers more wealth to less, and it is unnecessary to measure exactly how satisfaction

would increase for a given increase in wealth. Another preference specification is that the individual is risk averse.[1] If a choice between a certain amount of money and a risky prospect with the same arithmetic means money return is given, the individual will choose the certain amount. A third specification is that the individual's risk aversion decreases as the amount of wealth possessed increases. These three specifications correspond to the signs of the first three derivatives of the individual's utility function which is more general than specifying the mathematical form of the individual's utility function (as done in alternative decision models such as the geometric mean model). The SD decision model that is based upon these qualitative specifications, therefore, should be more generally applicable than a model that relies on an exact mathematical form of utility function or an exact form of statistical distribution for its theoretical validity.

The purpose of this paper is to show how stochastic dominance can be used to select and rank investments. Furthermore, it summarizes the relationship between the mean variance dominance criterion and stochastic dominance ordering rules. Also, it applies the stochastic dominance criterion to show that small stock returns dominate low-grade bond returns.[2]

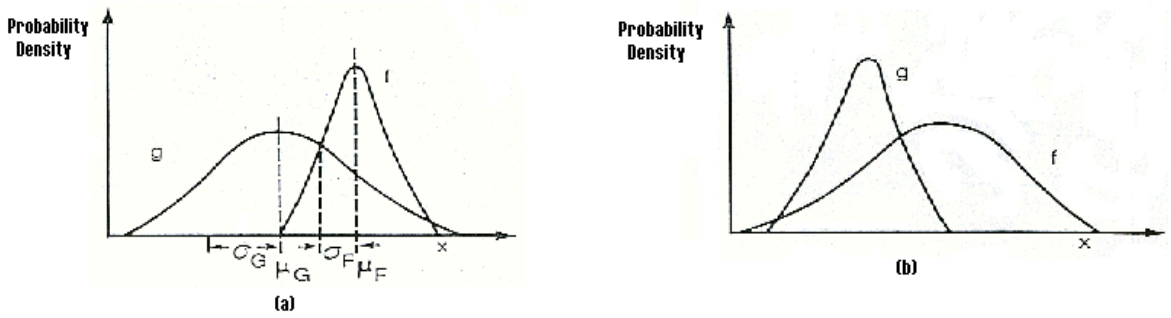
The reminder of this paper proceeds as follows. Section II presents mean-variance preferences ordering, section III introduces stochastic dominance model, section IV presents implementation of stochastic dominance, and section V summarizes.

MEAN-VARIANCE PREFERENCE ORDERING

The application of variance as a risk measure in portfolio analysis was promoted by Markowitz (1952), who suggested the famous mean-variance, or EV, ordering. In this theory the investor is assumed (or advised to make portfolio decisions through a series of tradeoffs between mean return μ and "risk" or "variability" as embodied in the standard deviation measure σ. In a choice between distribution functions of return F and G, a risk-avers investor is presumed to prefer F to G, or to be indifferent between the two, if the mean of F is as larger as the mean of G and the variance of F is not greater than the variance of G, i.e., if $\mu_F \geq \mu_G$ and $\sigma_F \leq \sigma_G$. Furthermore, if at least one of these inequalities is strict, then some investors prefer F to G in the strict sense and F is said to dominate G in the sense of EV. In this case G can be eliminated as a non-contender with no loss of optimality. If only one of the inequalities holds, the problem of choice depends on the individual's personal mean-variance tradeoffs, and neither F nor G can be eliminated under the criterion of EV dominance.

Using probability density function f and g to represent the distributions F and G, Figure 1a illustrates a case in which F dominates G in the EV sense since F has larger mean and smaller variance. Neither F nor G is EV dominates in Figure 1b since F has the larger mean but G has the smaller variance. Despite its simplicity and appeal, the EV dominance criterion, or EV rule, can fail to make a choice between two prospects even in obvious cases. As an example, consider outcomes X and Y, with distribution functions F and G respectively, for which P(X=\$1) = P(X=\$2) =1/2, and P(Y=\$1) = 1. Then μ_F = \$3/2 > μ_G = \$1, and σ_F = \$1/2 > σ_G = \$0. The EV rule, blindly applied, is unable to choose F for in preference to G even though F is obviously better than G for anyone who prefers a \$2 payoff to a \$1 payoff. Furthermore, EV analysis is generally not consistent with expected utility analysis in the presence of nonlinear utility functions, except in special cases.

Figure 1. EV Dominance (a) and Nondominance (b)



STOCHASTIC DOMINANCE RANKING RULES

There are three major types of stochastic dominance; first order (FSD), second order (SSD), and third order (TSD). The derivations of the three types of stochastic dominance are presented in the following subsection.

To derive proofs of the SD ranking rules, a choice of variables must be made. The investments' outcomes could be measured in terms of the individual's wealth, or the rate of return earned on investments. The most practical dimension seems to be wealth.

Using the notation X for wealth and U(X) for the utility function, the successive derivatives of the utility function are U' (X), U"(X), U"'(X), and in general $U_{[k]}$. The assumed sign of the first derivative, U′(X) is greater than zero, results from the assumption that an individual always prefers more wealth to less. The second sign, U″(X) is less than zero, is determined from the assumption that the individual is risk averse. The positive sign of the third derivative, U"'(X) is greater than zero, comes from the assumption that the individual becomes less risk averse as wealth increases. The general result is that even numbered derivatives should be negative and odd numbered derivatives should be positive. The typical admissible mathematical forms of utility function, are $U(x) = \ln X$, $U(X) = aX^b$, and $U(X) = M - e^{-ax}$ (where a is a positive constant, b is a constant with value between zero and one, and M is an arbitrary large positive constant).

The investment alternatives to be compared are assumed initially to have distributions of returns such that the individual's wealth is distributed continuously over the interval from a to b. Since wealth is the variable X, a is constrained to be positive. If the individual chooses the first investment, resulting wealth has the probability density function f(X). If he/she chooses the second investment, the probability density function of wealth is g(X). The SD ranking rules will always be in the form where the first investment dominates the second investment. The two investments are defined to be mutually exclusive, so a joint distribution of the two random variables is not relevant.

The SD ranking rules are derived by comparing the expected utility resulting from choice of the first investment to the expected utility from the second. Expected utility for the first investment is defined as

$$E_f(U) = \int f(X)U(X)dX. \quad (1)$$

This integral is not evaluated directly, but is integrated by parts to allow comparison of the two investments' expected utilities.

When $E_f(U)$ is integrated by parts, f(X) is assigned as dv and U(X) as *u* in the standard formula. The resulting expression involves the integral (antiderivative) of f(X), F(X) and the derivative of U(X), U′(X). The initial result of the integration is

$$E_f(U) = U(b)F(b)-U(a)F(a)- \int F(X)U'(X)dX. \quad (2)$$

The mathematical characteristics of the distribution function, F(X), can be used to simplify the expression. F(X) is the probability of an outcome of X or less for the random variable and, therefore, F(a) = 0 and F(b) = 1 for all distributions. The expected utility from the first investment is

$$E_f(U)=U(b)-\int F(X)U'(X)dX. \quad (3)$$

The expected utility from the second investment is derived by performing the same operations on $E_g(U)$ or by the simple substitution of g for f in the formulas,

$$E_g(U)=\int g(x)U(X)dX = U(X)-\int G(X)U'(X)dX. \quad (4)$$

If the expected utility of the first alternative is to be greater than that of the second alternative, then

$$E_f \geq E_g(U). \quad (5)$$

Substituting (3) and (4) into (5), the result is

$$U(b)-\int F(X)U'(X)dX \geq U(b)-\int G(X)U'(X)dX. \quad (6)$$

Simplifying and rearranging yields:

$$\int F(X)U'(X)dX \leq \int G(X)U'(X)dX. \quad (7)$$

The derivative of the utility function is the same on both sides of the expression. Since U′(X) is greater than 0 by assumption, the inequality (7) will hold if

$$F(X) \leq G(X) \text{ for all } X. \quad (8)$$

Inequality (8) is the ranking rule for FDSD.

First degree stochastic dominance (FDSD) often does not result in dominance between investments, making it desirable to pursue the higher degrees of SD models. Second and higher degree stochastic dominance ranking rules can be derived by further integrations of expected utility functions. Equation (3) can be integrated by parts with F(X) as dv and U′(X) as u in the standard formula to yield

$$E_f(U)=U(b)-F_1(b)U'(b)+\int F_1(X)U''(X)dX, \quad (9)$$

where $F_1(X)$ is the integral of F(X). $F_1(a) = 0$, but F_1 is not necessarily equal to one. Similarly, the expected utility from the second investment is

$$E_g(U)=U(b)-G_1(b)U'(b)+\int G_1(X)U''(X)dX. \quad (10)$$

If the expected utility from the first investment is to be larger than the expected utility resulting from the second investment, equations (9) and (10) can be substituted into inequality (5) to yield

$$U(b)-F_1(b)U'(b)+\int F_1U''(X)dX \geq U(b)-G_1(b)U'(b)+\int G_1(X)U''(x)dX \quad (11)$$

which can be simplified and rearranged as

$$F_1(b)U'(b)-\int F_1(X)U''(X)dX \leq G_1(b)U'(b)-\int G_1(X)U'(X)dX. \quad (12)$$

The property of risk aversion implies U″ is less than 0. Using the signs of the first two derivatives of the utility function, it is seen that if

$$F_1(X) \leq G_1(X) \text{ for all } X \quad (13)$$

then the inequality in (12) holds and the first investment is at least as preferred as the second investment by the expected utility criterion. Inequality (13) is the second degree stochastic dominance (SDSD) ranking rule.

SDSD can be expected to yield more frequent dominance between pairs of investments than FDSD. It is, therefore, a more powerful tool for discrimination. The increased power of the SDSD ranking rule adds results from the assumption about individual's utility function, U″(X) less than 0. One of the mathematical characteristics of positive valued functions is that their integrals must be ordered. If FDSD exists between two alternatives and F(X) is less than or equal to G(X) for all X, then $F_1(X)$ is less than or equal to $G_1(X)$ for all X. SDSD exists as well. FDSD implies SDSD. In considering the set of pairs of investment alternatives, the second degree test will detect all the pairs where preference exists that would be detected by the first degree test. The second degree test also may detect some additional cases of preference that failed the first degree test.

As the degree of stochastic dominance test is increased, the discrimination power becomes greater. Third degree stochastic dominance (TDSD) will detect more preferences than SDSD, and so forth. The TDSD rule is developed with another property of the utility function, decreasing risk aversion, or U"'(X) less than 0, and by a further integration by parts of the expected utility function. When equation (9) is integrated by parts, the result is

$$E_f(U) = U(b) - F_1(b)U'(b) + F_2(b)U''(b) - \int F_2(X)U'''(X)dX \quad (14)$$

If the expected utility of the first investment is to be at least as large as the expected utility of the second investment, then this inequality must hold:

$$F_1(b)U'(b) - F_2(b)U''(b) + \int F_2(X)U(X)dX \leq$$
$$G_1(b)U'(b) - G_2(b)U''(b) + \int G_2(X)U'''(X)dX. \quad (15)$$

Given the signs of the utility function derivatives U′(X) is greater than 0, U″(X) is less than 0, and U"'(X) is greater than 0, sufficient conditions for (15) to hold are:

$$F_1(b) \leq G_1(b), \text{ and } F_2(X) \leq G_2(X) \text{ for all } X. \quad (16)$$

Inequalities (16) form the TDSD ranking rule.

IMPLEMENTATION OF STOCHASTIC DOMINANCE

The first step in processing the data for SD tests is the approximation of the true underlying distribution functions by finite (and therefore discrete) sets of sample observations. For this purpose, the three dominance criteria must be redefined in terms of these discrete observations. This result is obtained by first listing the sample observations in ascending order such that if X_i and X_j are the ith and jth observations, then $X_i \leq X_j$ if and only if $i < j$. Note that although it is possible for two or more observations to have the same numerical value, for consistency in labeling, each observation is considered to be distinct. If there are K distinct observations of return on a given portfolio, then each occurs with a relative sample frequency $f(X_i) = 1/K$. The corresponding distribution function $F_1(X_n)$ is generated directly by summing these sample frequencies for all X_i, $i \leq n$. Finally, in the comparison of two probability functions, f(X) and g(X), there are a total of

N = 2K distinct observations. If the ith observation belongs to portfolio f, then $f(X_i) = 1/K$ and $g(X_i) = 0$; if it belongs to portfolio g, then $g(X_i) = 1/K$ and $f(X_i) = 0$. With this framework the SD rules can be restated as follows:

FSD: The probability function f(X) is said to dominate the probability function g(X) by FSD if and only if $F_1(X_n) \leq G_1(X_n)$ for all $n \leq N$ with strict inequality for at least one $n \leq N$, where

$$F_1(X_n) = \sum_{i=1}^{n} f(X_i) \qquad n = 1, 2, 3, \ldots\ldots, N$$

And

$$G_1(X_n) = \sum_{i=1}^{n} g(X_i) \qquad n = 1, 2, 3, \ldots\ldots, N$$

SSD: The probability function f(X) is said to dominate the probability function g(X) by SSD if and only if $F_2(X_n) \leq G_2(X_n)$ for all $n \leq N$ with strict inequality for at least one $n \leq N$, where

$$F_2(X_n) = \sum_{i=2}^{n} F_1(X_{i-1}) (X_i - X_{i-1}) \quad n = 2, 3, \ldots\ldots, N$$

And

$$F_2(X_1) = 0.$$

$G_2(X_n)$ is similarly defined.

TSD: The probability function f(X) is said to dominate the probability function g(X) by TSD if and only if $F_3(X_n) \leq G_3(X_n)$ for all $n \leq N$ with strict inequality for at least one $n \leq N$, and $F_2(X_n) \leq G_2(X_n)$ where,

$$F_3(X_n) = \tfrac{1}{2} \sum_{i=2}^{n} [F_2(X_i) + F_2(X_{i-1})] (X_i - X_{i-1}) \quad n = 2, 3, \ldots\ldots, N$$

And

$$F_3(X_1) = 0.$$

$G_3(X_n)$ is similarly defined.

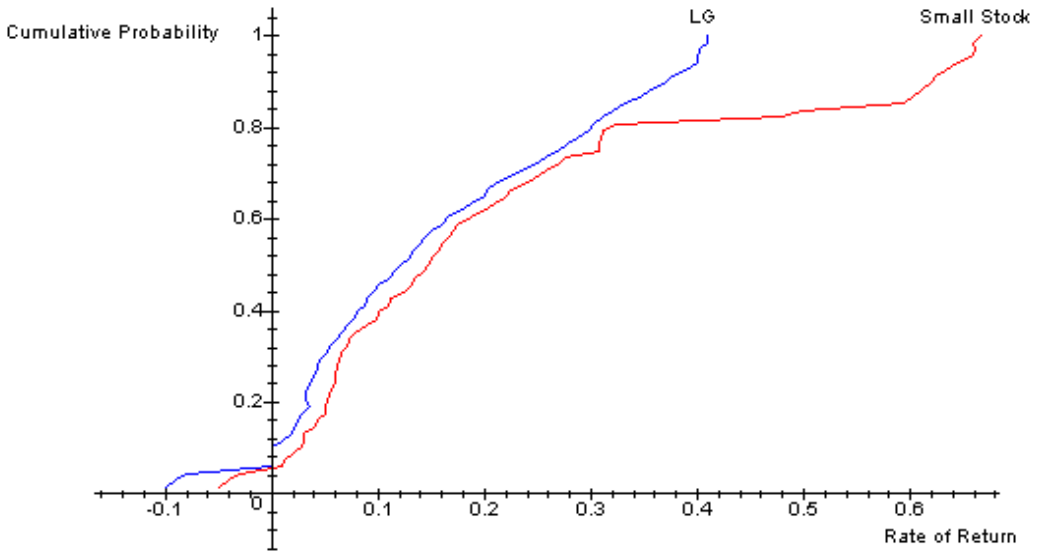
This study examines the distribution of January small stock and low-grade bond returns. To examine SD of small stock versus low-grade bond returns we construct the cumulative density function (CDF), the *n* realized monthly returns are ranked in increasing order. Since each observation has an equal probability of occurrence, each realized return is assigned a probability of 1/72.[3] Hence, the lowest realized return has a cumulative probability of 1/72, the second lowest realized return has a cumulative probability of 2/72. Finally, the highest realized return has a cumulative probability of 72/72 or 1. Plotting these points produces the empirical CDF.

To examine stochastic dominance in January returns across small stock and low-grade (LG) bond, Figure 2 shows the cumulative density function (CDF) of the realized total returns in January from 1926 to 1997. As Figure 2 shows, the CDF of small stock is shifted to the right, while the CDF of LG bond is shifted to the left. Figure 2 produces visual proof of the first-order stochastic

dominance of the January returns in small stock over the January returns in LG bond. Furthermore, Table 1 shows that small stock returns dominate low-grade bond returns for each month by first degree.

Table 1: Monthly stochastic dominance of small stock returns over low-grade bond returns from 1926-1997											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
FSD	FSD	FSD	FSD	FSD	FSD	FSD	FSD	FSD	FSD	FSD	FSD

Figure 2: Cumulative Density function of January Returns for small Stock and Low-Grade Bond



SUMMARY

This paper introduces the importance of stochastic dominance approach in decision making. Also, it explores the derivation of the various degrees of stochastic dominance ranking rules by integrating the expected utility functions of the two choice rules alternatives.

The stochastic dominance ranking model is a technique for ranking investments that avoids many of the assumptions required by other popular ranking models. For example, the widely used mean variance approach requires either the assumption of quadratic utility functions on the part of

investors or normal distribution of security returns for accuracy of rankings. By avoiding these restrictive assumptions, the stochastic dominance technique should be more generally applicable than alternative models.

By using stochastic dominance approach, this paper finds that small stock returns dominate low-grade bond returns over the study period from 1926 to 1997.

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ENDNOTES

[1]An investor who will not assume a given level of risk unless there is an expectation of adequate compensation for having done so.
[2]This paper is condensed to fit the guidelines of the proceedings. The complete paper is available upon request from the author.
[3]The number of years in this study is 68.

AN ANALYSIS OF INCOME GROWTH AND DISTRIBUTION IN SOUTH CAROLINA COUNTIES FROM 1930-1999

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ABSTRACT

The measurement and assessment of income inequality across nations has been a popular academic topic for decades. It is only more recently that academics have focused on regional and state income inequality issues. The economic development push of the 1980's gave additional impetus to this discussion. This paper attempts to address regional income inequality in South Carolina by measuring the Gini coefficients over approximately seventy years from county income data. In order to get a more complete picture of income inequality, background statistics on Unites States and South Carolina income inequality are discussed. The objective of the paper is to illustrate the overall trend in regional income inequality in South Carolina in order to gain a clearer picture of regional and state income inequality issues.

INTRODUCTION

Income distribution and issues of inequality is not a new area of study. For decades economists and policy analysts have reviewed income distribution data for the United States and countries around the world. The importance of measuring income distribution took on even greater importance beginning in the 1960's and 1970's as policy makers justified the importance of their income redistribution policies. Recently, income distribution has again taken a prevalent role in discussions as Census data reveals that even during strong U.S. growth of the 1990's income inequality was on the rise. Or as many policy analysts will attest "The rich got richer and the poor got poorer." With national and global income distribution issues taking on increasing importance, focusing exclusively on state and regional income distribution issues has become more common.

Throughout the 1980's, an increased emphasis was also placed on regional economic development in many states throughout the United States, especially in the lesser-developed South. In fact, this economic development movement led to the attraction of major foreign firms in several states in the South. There are a number of reasons attributed to the slow development of Southern States. Inevitably in all discussions related to this issue there is some emphasis placed on the disparity of income between the urban and rural areas of the South as being a cause for uneven development.

The relatively fast growth of urban areas of the South, like Atlanta, Greenville/Spartanburg, Charlotte and others, does not necessarily indicate a growing disparity in standard of living. To the extent that income is more evenly spread across a region, it may be that states or regions are

providing more equal living standards, even in the face of rapid population growth and industrial development in some locations compared to slow growth in other locations.

HYPOTHESIS

The purpose of this paper will be to analyze the equality of income distribution across the state of South Carolina over the sixty-nine period ranging from 1930-1999. Before looking at South Carolina specifically, this paper will review the status of income inequality in the United States and Southern states generally. South Carolina, along with other Southern states, have historically been relatively poor states. This period of time, especially 1960-1999, covers a time of rapid social and political change that might be expected to have possible impacts on the economic conditions of the state.

This paper presumes that county income inequality is another important tool in assessing regional income inequality issues. Moreover, it is hypothesized that even with increases in individual income inequality, county income inequality likely has made dramatic improvement in the past half century, especially over the past several decades. In order to measure this, a Gini coefficient of county income inequality is calculated. The objective is to ascertain whether income has been more equally spread across the regions of the state and to examine some of the reasons for the trends in any divergence of equality.

METHODOLOGY

The Gini coefficient is a measure of inequality that is based on the area under a Lorenz curve. A Lorenz curve shows the percentage of income relative to the percentage of population. For example, consider two regions with each region having 50 percent of the population. If one region has only 25 percent of total income and the other region has the other 75 percent, then clearly, income is unequally spread across the two regions. The Lorenz curves based on this example would illustrate curves that deviate substantially from a diagonal line of perfect equality.

The Gini coefficient is calculated as the difference in area between the diagonal line of perfect equality and the Lorenz Curve. In the case of a state, if each subunit (such as a county) has the same percentage of total state income as that subunit has of total population, then income is equally spread across regions of the state. In that case, the Gini coefficient would be equal to zero since the Lorenz curve would be identical to the diagonal line of perfect equality. Thus, the smaller the Gini coefficient, the more equal the spread of income.

The Lorenz curve and Gini coefficient have been the most widely used tools to analyze income distribution across different individuals in the population, but for this paper, the variable of analysis will be per capita county income and not individual income.

UNITED STATES AND SOUTHERN INCOME INEQUALITY

While the phrase, " The rich have gotten richer and the poor have gotten poorer," is often overused, in many cases it reflects the realty of income statistics in the United States. This phrase

is a reflection of the income inequality that has been observed in the United States. Over the past several decades' income inequality has been measured to assess whether inequality is increasing or declining. Unfortunately, the most recent news indicates that income inequality has been increasing since the late 1970's. The Center for Budget and Policy Priorities reports that from the late 1970's to the mid 1990's the income of the lowest income families in the United States fell by more than 20%, while over the same period middle income families saw their incomes fall by over $700 (The Center for Budget and Policy Priorities, 1997). In comparison, the average incomes of the highest income families increased by approximately 30%.

Throughout the 1990's there was considerable media coverage concerning the amount of income and wealth gains made by many Americans. The prolonged period of economic growth that the United States experienced throughout the 1990s led many analysts to believe that this growth was shared by a greater number of families than ever before. However, the evidence is quite clear that even with a decade of economic growth many lower and middle income families have experienced declining or stagnant income levels. Census data reported by the Center for Budget and Policy Priorities reveals that only the top two-fifths of American families have incomes higher than they did in the 1980's and the bottom three-fifth's of American families actually have lower incomes than they did a decade ago (Center on Budget and Policy Priorities, 1997). Thus, nationally the trend is that income inequality between the lowest fifth and the highest fifth, as well as between the middle fifth and highest fifth, has increased over the past three decades and throughout the 1990's.

On a state-by-state basis the trends in income inequality support this national trend. Census data reveals that in all but two states the income gap between the poorest 20% of families and the wealthiest 20% of families is significantly wider than it was twenty years ago (Center on Budget and Policy Priorities, 1997). In order to assess income inequality on a state by state basis, policy analysts' compare state's inequality ratios. This measurement calculates the ratio between the income held by the top 20% of households divided by the income held by the bottom 20% of households. Perfect equality would occur if the top 20% of households received 20% of income and the bottom 20% of households received 20% of income, with a ratio equal to 1.

All of the states in the Southeast, except one, had higher income inequality in 1994-1996 than they had in 1978-1980. Arkansas had lower income inequality in 1996 than they had in 1978-1980, in addition to being one of the southern states with the lowest income inequality overall. Of the fifteen states reported, only five states saw any decline in income inequality reported for these periods. Louisiana saw the most significant decline in inequality from the late 1980's to 1996. However, Louisiana is also reported as one of the top ten states where income inequality between the top and bottom and top and middle income earners was greatest between 1994-1996. It is worth noting that only three states in the United States, Alaska, Louisiana and Tennessee, saw a substantial decline in income inequality in the past decade (Economic Policy Institute, 2000).

For the South, several states continue to exhibit significant trends in income inequality. Alabama, Florida, Georgia, Kentucky, Tennessee, and West Virginia all are reported by the Center on Budget and Policy Priorities to have exhibited significant income inequality at some point in the past three decades. However, there are positive signs on the horizon. MDC, Inc. reports that between 1970 and 1996, the South's median family income rose 19.1 percent, compared to the U.S. as a whole where median income rose only 12.8 percent (MDC, 1998). Moreover, MDC reports that the

South now has a solid middle class that is growing. Reviewing income inequality for the United States and the South is important, but it does not reveal much specifically about individual states. Therefore, for this paper it is also important to look more specifically at South Carolina income inequality.

SOUTH CAROLINA INCOME INEQUALITY

South Carolina is one of the few states that have actually had a narrowing of income inequality over the past three decades. Median incomes for both low-wage and median-wage workers grew throughout the 1990's, after declining in the 1980's. Mishal, in the State of Working America, reveals inflation adjusted hourly wages of low-wage employees in South Carolina saw a 7.9 % increase from 1979 (Mishal, et al., 2000-2001). Workers in the middle of the wage category were even better off, with a 17.4% increase from 1979.

Largely due these gains in wages, South Carolina saw income inequality fall throughout the 1990's. Income growth of each fifth of South Carolina's population from the late 1970's-the late 1990's reveal this trend. While the richest fifth did experience the highest income gains of 33 percent, each fifth had significant income gains over the time period. Table 1, however, illustrates that even with these gains the division of income among each fifth of the population is not equally shared. By the late 1990s the lowest income fifth of the population received 6% of the income, while the highest fifth received 43% of the income. The third and fourth fifths, however, each receive close to their share of income (based on population), receiving 17% and 23% respectively.

Table 1: Share of Income Held by Each Income Fifth, Late 1990s.

Income Fifths	% Held by Each Fifth
$0 - $21,473	6%
$21,473 - $36,000	12%
$36,000 - $52,083	17%
$52,083 - $74,061	23%
$74,061 and over	43%

Source: Economic Policy Institute/Center On Budget and Policy Priorities

RESULTS: MEASURING REGIONAL INCOME INEQUALITY

As previously mentioned, one measure that can be used to determine inequality is the Gini coefficient. The Gini coefficient is based on the proportion of total income compared to the proportion of total population. Perfect equality would result in a value of zero (0) for the Gini coefficient.

In this study, the Gini coefficient is calculated as a measure of county income inequality across South Carolina. The perception has been that economic growth has occurred in a few urban centers while the rural areas have been left behind. Thus, the expectation is that the Gini coefficient

as a measure of regional income inequality would have increased over time. The results of these calculations are shown in Table 2 for the time period 1930 - 1999 in ten-year intervals except for the last decade. County income data is not currently available for the year 2000.

Table 2: Gini Coefficients and Rate of Income Growth for South Carolina, 1930 - 1999.

Year	Gini Coefficient	Rate of Income Growth For Decade
1930	.132	
1940	.104	33.3
1950	.088	75.5
1960	.090	19.6
1970	.064	70.1
1980	.056	-7.3
1990	.033	105.9
1999	.035	46.7

The results of the Gini coefficient calculations indicate that significant progress has been made in reducing income inequality across the regions of the state since 1930. The 1999 number is slightly higher than the 1990 number; however, the same thing happened during the decade of the 1950s and the long-term trend continued down over the next 30 years. In addition, the absolute value of .035 indicates that regional income inequality is not a major issue for the state to consider when allocating economic development energies. While this analysis does not indicate the factors that have led to the decreased regional inequality, it is obvious that from an income perspective, there has been significantly decreased inequality over the last 70 years.

It is interesting to note also that rapid income growth tends to be correlated with improvements in income inequality. During the two decades of highest income growth in the state, the Gini coefficient decreased indicating decreasing income inequality. However from 1990 to 1999, income grew relatively rapidly but the Gini coefficient actually increased slightly. Could it be that once regional income inequality decreases to a certain level that it becomes increasingly difficult to make further gains?

In relation to regional economic development theory, one theory supports an inverted U shaped theory of growth. Based on this concept, a region will initially face increased income inequality as it begins to develop followed by spread effects that will allow income inequality to decrease as a larger group shares in the benefits of economic development. This theory is not supported by the history of Gini coefficients in South Carolina where the trend has been toward decreasing regional income inequality since 1930.

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OLIGOPOLISTS THEN AND NOW: A STUDY OF THE MEATPACKING INDUSTRY

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ABSTRACT

For decades academic discussion has debated the importance of industry structure on economic performance. A.D. Chandler in his classic 1962 study, Strategy and Structure, argues that the unprecedented industrialization of the late 19th century led to industrial enterprises like the U.S. had never before seen. Chandler specifically focuses on firms like DuPont, General Motors, Standard Oil, and Sears Roebuck and Company. However, Chandler also points to meatpacking as an industry where structure followed strategy. Meatpacking was a significant national industry as the twentieth century began and remains a major economic force at the start of the twenty-first century. Increasing concentration, vertical integration and oligopoly characterized the industry in 1900 and does as well today. The industry's structure, then and now, has been driven by a national market strategy out of the necessity to minimize costs and an aversion to risks.

This paper explores the hypothesis that the meat packing industry has had an evolution that, even with public policy changes, continues to push the industry towards oligopoly (at times monopoly) and from all appearances will continue to do so. While the firms today are not the same as they were in 1890, 1945, or 1970, they continue to be highly motivated by consolidation and integration. The paper will begin by tracing the historical development of the meatpacking industry, the regulatory response to the industry, and finally discuss the literature and current consolidation within the industry. After doing this, the paper hopes to reveal that there is a common thread that runs through the meatpacking industry and that is that economies of scale and cost advantages of integration are the driving force in 2002 just as they were in 1900. It appears that in the case of the meatpacking industry, especially beef and pork, history sometimes repeats itself.

INTRODUCTION

The structure of modern American industry and enterprise has been a topic of popular and academic discussion and an issue of debate among economists and policymakers for nearly 125 years. A.D. Chandler in his classic 1962 study, Strategy and Structure, argues that the unprecedented industrialization of the late 19th century led to industrial enterprises like the U.S. had never before seen. Chandler points to the meatpacking industry as one where structure definitely followed strategy.

Beginning in the 1870s, consolidation and integration (both vertical and horizontal) proceeded with dizzying speed and transformed the economy. By the end of the 1890s, oligopoly, virtual monopoly or shared monopoly characterized American industry. In many cases, firms in oligopolistic or monopolistic industries enjoyed economies of scale and scope, along with increased

production and lower prices for consumers. However, predatory actions and other negative consequences of market power produced a popular clamor against the trusts.

As protests rose, the demand for public control of big business became a reality. The demands for public restraints on business led to the passage of historic legislation, of which the Sherman Anti-Trust Act of 1890 is now the foundation. However, neither enforcement nor interpretation of anti-trust law has been consistent over the course of the twentieth century. As well, anti-trust action continued to be in the popular media in the twentieth and now the twenty-first century as concerns over increasing concentration in a variety of industries takes on momentum.

HYPOTHESIS

This paper explores the hypothesis that the meat packing industry has had an evolution that, even with public policy changes, continues to push the industry towards oligopoly (at times monopoly) and from all appearances will continue to do so. While the firms today are not the same as they were in 1890, 1945, or 1970, they continue to be highly motivated by consolidation and integration.

MEATPACKING - HISTORICAL DEVELOPMENT AND REGULATION

The meatpacking industry has experienced several periods of structural change and consolidation during the past 120 years. Meatpacking was part of each of the great merger waves, the 1890s, 1920s, 1960s and later in the 1970s and 1980s. In the later half of the nineteenth century, meatpacking firms developed into a national industry, with consolidated control and a changed market structure. Oligopoly (collusive or not) characterized the industry in the twentieth century's first decade. The rapid urbanization of the nation, coupled with the growth of herds of animals on the western plains, the extension of the railroads, both trunk line roads to the Eastern cities and roads to the west, and the development of dependable refrigeration, made possible the development of a national market.

Gustavus Swift led the development of the national industry. Swift & Company established vertical consolidation in the industry and grew to include stockyard ownership, slaughter, processing, distribution to branch houses, and sales at both the wholesale and retail levels. As the twentieth century began, five firms led the industry with Phillip Armour's, Armour & Co., and Swift & Co. the largest. Armour & Co. ranked number eight among U.S. industrial firms in 1909 in value of assets; Swift & Co. was number thirteen (Chandler, 1962). The big five meatpacking firms controlled almost 100 percent of the refrigerated, dressed beef production in 1906 (Libecap, 1992).

At the national level, the first regulatory response to consolidation in the meatpacking industry came in 1891. The passage of the Meat Inspection Act of 1891 was a product of the fundamental changes that had occurred in the meatpacking industry during the 1870s and 1880s. Libecap contends that the consolidation of market power in the hands of four Chicago meatpackers played a prominent role in the enactment of both the industry specific legislation in 1891 and the Sherman Anti-Trust Act of 1890 (Libecap, 1992). However, the difficulty involved in measuring true concentration within the industry spared the big five the trust busting prosecutions suffered by

U.S. Steel and Standard Oil in the twentieth century's second decade. Although, public protest over industry abuses helped spur passage of the Meat Inspection Act of 1906.

Concerns over concentration in the industry continued and led Congress to initiate a full-scale investigation of the meatpacking industry after World War II. However, the oligopolistic structure of the industry remained intact throughout the 1950s. In 1959 Armour & Co. and Swift & Co. were among the top 100 U.S. industrial firms based on the value of assets (Chandler, 1962). However, structural change in the industry occurred as union strength waned and technological improvements became available in the 1960s and 1970s. Research by Craypo reveals that union strength peaked in the meatpacking industry during the 1960s and up through the mid-1970's (Craypo, 1994). By 1988 unionization had fallen to approximately half of its 1963 level, and nominal wages in the 1990s fell below the hourly wage in 1960 (Huffman and Miranowski, 1996)

The oligopolists of the first half of the twentieth century became pawns in the wave of conglomeratization that swept the nation in the 1960s and 1970s. Wilson & Co. was bought by LTV, and its assets divided into a meatpacking firm, a sporting goods firm and a pharmaceuticals firm (Brown, 1972). Armour & Co. became the target of Gulf & Western; was acquired first by General Host and later became part of Greyhound (Sobol, 1984). Research by Ussif and Lambert reveals some of the changes that were occurring in the industry during this time (Ussif and Lambert, 1998). Their research concluded that monopoly power in the meatpacking industry peaked from 1974-1978. However, in 1979 monopoly power in the meatpacking industry fell sharply and stabilized for a period after 1980.

A new generation of meatpackers emerged in the 1980s. Armour & Co. and Swift & Co., along with Monfort of Colorado and a host of processing firms became part of the Omaha-based Con Agra food combine. Iowa Beef Packers, Inc. (IBP) grew from a small firm on the fringe of the national market into one of the largest in the industry. Cargill, the Minneapolis agricultural product firm, moved its Excel meatpacker into a position of prominence. The industry, as the twenty-first century begins, is more concentrated than at any time in the twentieth century. By the 1990s, three major firms rule the pork and beef industry. They replaced the big five of an earlier time. Thus, as history repeats itself, concerns have arisen about increasing concentration and control within this industry.

CONCENTRATION, INTEGRATION AND MARKET STRUCTURE

There has been a significant amount of literature emphasizing the concentration and market power that exists in the meatpacking industry. Azzam and Anderson reported, based on earlier studies, that concentration could impact the prices charged and quantities sold by firms. Their research also noted the importance of technological development and firm rivalry on changes within the industry (USDA, GIPSA, 1996). Technological changes in this industry have been a major factor in improving cost advantages and economies of scale. From a historical perspective some of the most important technological changes in the meatpacking industry have been (1.) The development of cellulose casings and skinless hot dogs in the 1920s. (2.) The development of the refrigerated rail car/truck in the 1930-40s. (3.) The development of vacuum packing in the 1950s, and (4.) The development of boxed beef in the 1960s (Food Engineering, 2000).

As technologies improved, beef processing moved to towns and cities in rural America replacing outmoded plants with new specialized facilities closer to supplies, and providing the added benefit of lower labor costs. Huffman and Mirankowski confirm that concentration in large specialized operations occurred as refrigeration, processing and packaging for meat improved (Huffman and Miranowski, 1996). Moreover, additional research shows that in the twenty-five years from 1967 to 1992, the meatpacking industry experienced a general shift to greater plant scale (Ollinger, MacDonald, Handy and Nelson, 1996). This pressure on the beef and pork industries results from one of the basic tenets of supply and demand. As the demand for poultry has increased, a substitute product for beef and pork, more pressure is placed on the beef and pork industry to consolidate and find cost-saving measures. Additional research confirms that changes in consumer demand have been a significant factor in the recent structural transformation of the meat industry (Bastian, Bailey, Menkhaus, and Glover, 1994).

Risk aversion is the focus of Khan and Helmers discussion of vertical integration in the beef industry. They conclude that (1.) Improved efficiency, (2.) Reduced uncertainty of input and output prices and, (3.) Reductions in operations cost have moved the firms in the industry to increased vertical integration (Khan and Helmers, 1997). At the same time, Featherstone and Sherrick cite the integrated firm's ability to gain market advantage, increase efficiencies, reduce uncertainty and gain cost advantages (Featherstone and Sherrick, 1992).

Given the notable structural changes within the industry it is important to measure the degree of concentration within the industry. One of the easiest ways to measure degrees of monopoly power, or divergence from perfect competition, is to examine concentration ratios. Admittedly, concentration ratios have several limitations. For example, some industries appear to have low concentration levels nationally, but in fact exert significant market control locally and/or regionally. As well, industries can exhibit high degrees of concentration even though the four or eight largest firms have significant levels of interfirm competition.

Table One presents initial data on the concentration ratios within the meatpacking industry. SIC (Standard Industrial Classification Index) codes 2011 and 2013 represent several different categories of meat industrial firms, including canned meats, meat extracts, and meatpacking plants. As the data indicates, SIC firms classified under 2011 have much higher concentration ratios than those under 2013. SIC code 2011 includes meatpacking firms. Based on these figures it can be argued that this industry exhibits at least a moderate measure of concentration. The data further reveals that while this industry has approximately 1300 total firms, the eight largest firms account for less than 1 percent of this total but account for 66 percent of the value of shipments.

Table Two, on the following page, looks specifically at the beef packing industry. Overall, the trend from 1980 to 1995 is increasing concentration. In fifteen years, significant increases in four firm concentration ratios have been exhibited in the steer/heifer, cow/bull, cattle and boxed beef segments of the beef industry. By 1995 the four firm concentration ratios were 79.3, 23.5, 67.3 and 84.3 respectively in the steer/heifer, cow/bull, cattle and boxed fed beef markets. This establishes that not only is there moderate to substantial concentration in the industry, but that concentration has been increasing

Table I: Concentration Ratios by SIC Code							
SIC Code	# of Companies	Shipments Millions $	Percentage of Value of Shipments Accounted for by Largest Firms				Herfindahl-Hirshmann Index
			4	8	20	50	HHI
2011	1296	6958.7	50	66	79	88	777
2013	1128	5478.3	25	33	46	62	210
Source: U.S. Census Bureau. Manufacturing Concentration Ratios. Economic Census, 1992.							

Table II: Four-Firm Concentrations: Beef Packing				
Year	Steer/Heifer	Cow/Bull	Cattle	Boxed Fed Beef
1980	35.7	9.7	28.4	52.9
1985	50.2	17.2	39	61.5
1987	67.1	20	54.2	79.5
1990	71.6	20.4	58.6	79.3
1993	79.8	24	66	82.7
1994	80.9	26.3	67.8	85.7
1995	79.3	23.5	67.3	84.3
Source: U.S. Department of Agriculture, Packers and Stockyards Statistical Report: 1995 Reporting Year, GIPSA 97-1, September 1997, Tables 27, 28, and 29.				

The Herfindahl-Hirshman Index (HHI) is another useful measure of concentration. This measurement is considered superior to concentration ratios because it takes into account the number of firms and the relative distributional shares of the market held by all firms, not just the largest. The HHI is calculated by taking the sum of the squares of each firm's percentage share of the market. Below, Table Three reveals the HHI merger and concentration guidelines set by the Department of Justice and the Federal Trade Commission. The basic guidelines set by these agencies reveal that when an industry exhibits moderate or high concentration there are potential competitive concerns when mergers occur.

TABLE III: DOJ and FTC Merger Guidelines	
Post-Merger HHI below 1,000	This is considered unconcentrated
Post-Merger HHI between 1,000-1,800	This is considered moderately concentrated
Post Merger HHI above 1,800	This is considered highly concentrated
Source: USDA, Concentration Measures for the Beef Packing Industry. TB-1874, 1996.	

The HHIs illustrated in Table Four, reveal the significant increase in market concentration that has occurred in the meatpacking industry over the fifteen-year period from 1980-1995. All segments of the beef-packing industry have exhibited a significant increase, with Steer/Heifer, Cow/Bull, and Cattle exhibiting the largest percentage change in the HHI. Today the HHI for the Steer/Heifer and Boxed Beef segments indicate a level of concentration such that the Department of Commerce would likely deny a request for further mergers within that segment of the industry. As well, the Cow/Bull segment would be considered moderately concentrated and would warrant further research.

Table IV: Herfindahl-Hirshman Index

Year	Steer/Heifer	Cow/Bull	Cattle	Boxed Fed Beef
1980	561	89	361	1,220
1985	999	160	617	1,527
1987	1,435	206	946	1,981
1990	1,661	223	1,118	1,988
1993	2,052	276	1,393	2,236
1994	2,096	320	1,460	2,340
1995	1,982	293	1,437	2,208

Source: U.S. Department of Agriculture, Packers and Stockyards Statistical Report: 1995 Reporting Year, GIPSA 97-1, September 1997, Tables 27, 28, and 29.

In 1890, Armour, Swift, Morris and Hammond, the 4 largest Chicago meatpackers, slaughtered 89 percent of the cattle in Chicago and by 1904 these firms controlled 50 percent of the meatpacking market (Libecap, 1992). In order to maintain and improve this market share, the Chicago meatpackers were entrepreneurs in the use of refrigeration and large centralized slaughterhouses. By 1917, the major Chicago packers controlled 93 percent of the U.S. total for the storage and distribution of dressed beef, along with significant control over the refrigerator cars to transport the beef around the country (Libecap, 1992). By several estimates, the U.S. meat industry was the first or second most valuable U.S. industry for the thirty-year period, from 1880-1910. While the meat industry today is certainly not the most valuable U.S. industry, it is still valuable and provides commodities that consumers need and want. Similarly, meatpackers today have been able to increase their market share through changes in technology, plant scale, and merger activity. As a result, the four largest firms across the different sectors of beef packing control between 24 percent and over 80 percent of their respective markets. Thus, just as in 1910, this industry is characterized by its high level of concentration and a few large firms.

CONCLUSION

It is acknowledged that all firms across all industries seek to minimize cost and improve their market share. This is an enduring feature of our capitalist economy and the drive for profits. However, this research reveals the possibility that some industries may experience this pressure to a greater extent than others may. If this is the case, then some industries may have a natural drive or push towards oligopoly and/or monopoly structure. Meatpacking was a significant national industry as the twentieth century began and remains a major economic force at the start of the twenty-first century. The industry's structure, then and now, has been driven by a national market strategy out of the necessity to minimize costs and an aversion to risks. As well, firms within the industry continue to pursue economies of scale and scope. It appears that in the case of the meatpacking industry, especially beef and pork, history sometimes repeats itself.

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PUBLIC VS. PRIVATE SCHOOLS: THE IMPACT ON WAGE RATES

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ABSTRACT

Educational reform in general and school vouchers in particular remain a topic that attracts a lot of attention. Using data from the National Longitudinal Survey of Youth, I confirm previously obtained results in the literature that, on average, individuals who attended a private high school earn higher hourly wages than those who attended a public school. I then go on to show that the rates of return to schooling differ between public and private schools. This result holds whether an intercept dummy is included in the model or not. Finally, separate regressions for the two groups–which allows for greatest flexibility because all coefficient estimates can vary across the two groups of individuals–suggest that indeed the rates of return ro education differ between public and private schools. While this difference is not estimated with high precision, it is rather sizable.

MEASURING PRODUCTIVITY IN THE INFORMATION TECHNOLOGY ERA: DO CURRENT MODELS UNDERESTIMATE PRODUCTIVITY GROWTH?

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ABSTRACT

Overall, productivity growth may be underestimated in the U.S.; despite continued progress, measurement and conceptual barriers remain. The concerns about underestimation of productivity growth have been focused on data for the business sector, especially its service components. Current techniques do not capture the impact of new information technology on economic performance. This is why statistics may help to clear up ambiguities and start provide a fresh outlook to properly analyze successes of the service industries as a result of information technology.

INTRODUCTION

Economics, like every social science, is incomplete and therefore constantly evolving. A central concern of economics has to do with productivity-the ability to grow wealthier by extracting more value from the same amount of labor. Productivity is the measure of economics, which is the study of how a society uses its limited resources to produce, trade, and consume goods and services. In other words, the world has to satisfy unlimited wants with limited resources.

Looking at the constantly growing amount of new products and technological improvements at the end of the twentieth century, people are tremendously impressed. It seems logical that these inventions and improvements are increasing consumer welfare, and the technical innovations are contributing to output. Then why is the question of whether or not these new products and technological improvements are increasing at a noticeable rate? Logical reasoning supposes one thing, but officially, reported numbers do not support this assumption of productivity growth.

PRODUCTIVITY RELATIONSHIPS

The relationship between information technology (IT) and productivity is widely discussed but little understood (Brynjolfsson, 1993). Delivered computing power in the U.S. economy has increased by more than two orders of magnitude since 1970, yet productivity in the service sector has stagnated. Because improvements such as technical changes and new product discoveries reportedly bring cause a decrease in government measurements of productivity, many believe that there must be some discrepancy in the data collection and/or analysis (Dean, 1995).

What exactly is productivity? Simply stated, productivity is output per unit of input. The term productivity is often confused with the term production. Although there is a close relationship, production is concerned with the activity of producing goods or services while productivity relates

to the efficient utilization of inputs in producing prescribed outputs of goods or services. Calculating a number can become complicated. For example, suppose the accepted formula for calculating productivity output is the Cobb-Douglas Function:

$K=a*p*y/w_K$ $L=b*p*y/w_L$

where Y is the aggregate output, K is the capital stock, L is the labor input, w is the time-period index, and a/b are constants. The problem is not that we have bad equations; it is finding the correct variables for each particular industry. Determining what means input and output, in itself, is often obscure because no one method is standard for all businesses (Hall, 1999).

INPUTS/OUTPUTS

Although recent productivity growth has rebounded somewhat in manufacturing industries, the negative correlation between the advent of computers and the economy-wide productivity is the basis for many arguments that information technology has been counter-productive. One should keep in mind that relative productivity cannot be directly inferred from the number of information workers put in per unit output. For instance, if a new delivery schedule optimizer allows a firm to substitute a clerk for two truckers, the increase in the number of white-collar workers is evidence of an increase in their relative productivity. A financial service center is another example of how complexly the measurement of output per input is being utilized. Particularly, some banks consider deposits as their input capital while others consider it as their available output capital. One bank may classify deposits as a payback for services made available, while another bank would categorize deposits as credit for future customers. Neither method is more correct than the other. Measurement problems in the service industry arise because many service transactions are idiosyncratic and cannot be evaluated as aggregates. Therefore, classification and/or categorization become arbitrary even with abundant data (Brynjolfsson, 1993).

Even when considerable data on revenues of service industries is available, the data does not provide a measure of output that distinguishes changes in price over time from changes in real output. Measuring service industries' output first involves identifying the unit of output and then dealing with the issue of quality change. The usual way to measure the real output of the industry when employing typical sources of data is to deflate a nominal measure of output for the industry with the price index for the industry's product. When constructing a price index for deflating nominal output, it is necessary to specify first exactly what is being purchased or the basic transaction unit of the product. Then, the characteristics such as cost of production and profit that determine its price are evaluated. The variation that occurs in a given characteristic over time or among suppliers amounts to a change in quality of the product. If the price of a product rises due to an improvement in one of the characteristics of the product, one would attribute the increase to a change in the product's quality, and not to an inflationary price change. One technique attempts to measure the unit of transaction of the service, while the other attempts to measure the outcomes of the service (Sherwood, 1994).

WHEN TO MEASURE

It has been said that traditional measures of the relationship between inputs and outputs fail to account for nontraditional sources of value. Another source of the mismeasurement may stem from the significant lags between the cost and the expected benefit. The idea that new technologies may not have an immediate impact is common. While the benefits from investment in infrastructure may be large, they may be indirect and often not immediate. Most of the output of computer-using industries is intermediate, not final (Hall, 1999). By definition, all of business services, except for exports, and all of wholesale trade are intermediate products. Although finance, insurance, and communications contributes to final output in their sales to consumers, much of their output goes to industries that primarily produce intermediate output. If only short-term costs and benefits were measured, then it might appear that the investment was inefficient.

The coincidence of the technological explosion and the falling productivity growth has puzzled many observers (Triplett, 1999). Because of its unusual complexity and novelty, a person entering the IT business often requires some experience before becoming proficient. People may need substantial amounts of learning in order to use computers effectively. After modifying a standard model to require that learning accompany a technological change, the statisticians may discover that a technological change can boost output growth in the end, even though it causes an initial period of lower productivity. The use of computers, in the end, is efficient in increasing the quality of the goods produced (Stainer, 1997).

QUALITY

The computer industry has long struggled with the problem of showing the business payoff of IT investments in a tangible manner. Traditional methods of productivity measurement do not satisfy many non-information system (IS) executives, who prefer to point to U.S. government statistics showing stagnant white-collar productivity in recent years despite heavy spending on computerization (Triplett, 1999). The payback exercise was challenging enough when mainframe computers were the norm but has become exponentially harder as computers proliferate into nearly every tributary of business. The possible solution is to look at the long-term viability of the corporation, which is very much affected by non-financial measures such as customer satisfaction, quality, and the ability to rapidly deploy customer-driven products. Using only financial measures to improve performance is analogous to concentrating on the scoreboard in a football game. While the scoreboard tells you whether you are winning or losing, it does not provide much guidance about the plays that should be called. What is needed is information about the intermediate decisions that ultimately affect the score. Measures are needed of the underlying processes and prior outcomes that lead to superior financial results.

When comparing two output levels, it is important to deflate the prices so they are in comparable real dollars. Accurate price adjustments should not only remove the effects of inflation but also adjust for any quality changes. Much of the measurement problem arises from the difficulty of developing accurate, quality-adjusted price deflators.

Output is defined as the number of units produced times their unit value, proxied by their real price. Establishing the real price of a good or service requires the calculation of individual price "deflators" that eliminate the effects of inflation without ignoring quality changes (Brynjofsson, 1993).

MISMANAGEMENT

Many of the difficulties researchers encounter in qualifying the benefits of IT also affect managers. As a result, they may have difficulty in bringing the benefits to the bottom line if output targets, work organization, and incentives are not appropriately adjusted. Therefore, IT might increase organizational slack instead of output or profits. Sometimes the benefits do not even appear in the most direct measurements of IT effectiveness. This stems not only from the intrinsic difficulty of system design and software engineering, but also from the fact that the rapidly evolving technology leaves little time for time-tested principles to diffuse before being supplanted (Sherwood, 1994).

A related argument derives from evolutionary models of organizations. The difficulties in measuring the benefits of information and IT outlined previously may also lead to the use of heuristics, rather than strict cost/benefit accounting to set levels of IT investments. In current institutions, heuristics and management principles evolve largely in a world with little IT. The radical changes enabled by IT may render these institutions outdated. The rapid speedup enabled by information systems may have created unanticipated bottlenecks for each person in the information processing chain. A successful IT implementation process must not simply overlay new technology on old processes (Stainer, 1997).

OTHER ARGUMENTS

A very simple mismeasurement of the productivity lag could be explained by the usage of the arithmetic scale, as opposed to the logarithmic scale. To have an impact on productivity, the rate of new product and new technology introductions must be greater than in the past, and not just in their numbers. Suppose increases in productivity come strictly from the development of new products. For argument's sake, let the initial production rate be five percent. This means that five new products were produced in the period following one in which there existed 100 products. The next period on the measurement must produce six new products. Then, seven new products must come about in the subsequent period. At the end of ten years, a constant productivity growth rate requires 30 new products, and after 20 years, 283 new products and so on. As the economy grows, an ever-larger number of new products are required just to keep up the productivity growth rate constant (Triplett, 1999). This illustrates how society needs a deeper understanding of productivity and its intricate components.

Statistics illustrate that personal computers have not brought about productivity gains in many organizations, but employees are deeply tied to them (Triplettt, 1999). Productivity may not be useful to measure and may not apply to every role in a company. Productivity measures how much a person, group, or machine can make in a unit of time and matters only in repetitive processes

analogous to factory work. Effectiveness, of which productivity is only one measure, is a more general and far more useful measure of value for IT-services organizations. It can often only be measured subjectively.

EVALUATION

Rapid innovation has made IT-intensive industries particularly susceptible to the problems associated with measuring quality changes and valuing new products. The way productivity statistics are currently kept can lead to bizarre anomalies. For example, to the extent that ATMs lead to fewer checks being written, productivity statistics appear lower (Triplett, 1999). Because information is intangible, increases in the implicit information content of products and services are likely to be underreported compared to increase in materials content.

A significant amount of research has been written analyzing service productivity. The research states that there are many disadvantages in the investment policy, technological improvement, quality control systems, organizational behavior, and structural organization of the economy (Triplett, 1999). To address this problem, a great number of productivity improvement programs based on technological modernization, long-term investment policy, and organizational improvements have been introduced and utilized in the U.S. Some attempted to analyze productivity in connection with losses that occurred during the production process. The main idea of this approach is to base productivity improvement on a new measurement system that fully describes the productivity behavior according to loss variation. The system should be able to produce scientifically based recommendations in productivity improvement (Stainer, 1997).

CONCLUSION

Productivity statistics can help in understanding the growth and prosperity of nations. With a firm grasp of the most widely used statistics, one can better understand current debates such as those on the causes of lower productivity growth in the last quarter century. The controversy over the slowing productivity growth may remind people of the old line that if all the economists in the world were laid end to end, they would not reach a conclusion (Webb, 1998). In this case, the importance of the problem has led economists to explore possible explanations, but lack of definitive data has prevented a consensus from emerging. More research is needed.

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CURRENCY BOARD AGREEMENT AND ITS ROLE IN THE DEVELOPING COUNTRIES

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ABSTRACT

Currency Board Agreement (CBA) is a popular tool for curbing hyperinflation processes in developing countries. This paper will discuss the role of CBA in the transition economies in Eastern Europe. The advantages and disadvantages of establishing a currency board versus a central bank will be presented briefly. The focus will be on the future development of economies, operating under a Currency Board (CB). The argument is that in the long run the CB mechanism is cruelly stifling the already embattled economies in the specific circumstances of post-communist Europe. In support of this viewpoint, the principles of the economic theory of fixed exchange rates will be presented.

ASSURANCE OF LEARNING FOR ECONOMICS: A PROBIT ANALYSIS OF PERCEIVED STUDENT ABILITIES

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ABSTRACT

Assurance of Learning and outcome assessment have emerged as significant issues for national accreditation agencies such as the Association to Advance Collegiate Schools of Business, AACSB International. All institutions seeking accreditation must comply with the standards set forth, however, the standards apply differently based upon the missions and objectives of different schools. The individual institution's assessment processes are a key element in interpreting the application of the peer review process. However, there is no clear paradigm for assurance of learning to interpret understanding provided by a collegiate curriculum. This paper suggests an approach to assess and interpret the change in economics understanding across a curriculum based upon student perceptions of their own mastery of economic concepts. Students do not report an ever-increasing capacity to master economic concepts. Some courses lead to a heightened self-perception of student competencies, while other provide a more humbling perspective. Some courses advance the students understanding by lowering the relative perception of their skills. A probit analysis is used to evaluate which courses significantly alter student perceptions and in which direction. This provides tangible evidence to guide curriculum design and reform.

INTRODUCTION

The existing missions driven AACSB standards have been in place for more than 10 years and include the requirement to show that changes are made on most policies based on data rather than intuition. The current guidelines are under intensive review with a preliminary set of new standards already made available to the membership for discussion. Although it must be stressed that the current report is very preliminary, it is meaningful in its direction. In the proposed new standards, assessment of student learning goes from an undercurrent to center stage. A new standard, "Assurance of Learning" is now included as one of primary criterion for evaluation (Blue Ribbon Committee on Accreditation Quality, 2002). This new section describes areas of general knowledge and abilities and well as specific competencies in each level of degree offered. It also specifies examples of what measurements are expected and how such measurements are intended to be used.

> *"Student learning is the central activity of higher education. Key features of any educational program are the unit's definition of learning expectations and how the school assures that graduates achieve leaning expectations."*

The emphasis on the assurance of learning follows a trend that is at least fifteen years old but after a few years of stagnation, is again accelerating. In the 1980's and early 1990's assessment was the driver of reform in the areas of innovation and accountability. In the late 1990's interest was still high but with the complication of performance funding or performance budgeting. As of 2001, thirty-six states have some form of linking outcomes to financial support (Rockefeller Institute of Government, 1997). From AACSB International, to ABET to education, universities seeking accreditation must demonstrate how process are in place to measure outcomes and use outcomes. All eighteen of the US Department of Education "approved" accrediting organizations have some emphasis on outcome assessment as part of the review.

Defining competencies and discussing coverage and mastery of the concepts as a part of assessment have at least one very desirable secondary consequence. Faculty will talk about teaching as never before. They will talk about the need for prerequisites and other structural components of curriculum. They will collaborate and evaluate instructional methods, as they have never done before on teaching. Perhaps they have dealt collaboratively on research but not ever on teaching and competencies from classes.

ASSESSING LEARNING BY ECONOMICS STUDENTS

The National Council on Economic Education (NCEE) has proposed voluntary content standards for economic education (NCEE, 1997). This has supported increased momentum in providing students in K-12 with basic economic education (Stone, Parker 1998). Even with the increase in emphasis on economic education determining how much economics students have learned remains an important assessment challenge.

The economics faculty at Winthrop University adopted an assessment instrument that provides students with a list of terms and concepts that they may have been exposed to in their upper level economics courses. The student is asked to rank their perception of their ability to use the analysis described. The assessment is done in one upper level economics course toward the end of each semester. Since economics majors do not all take upper level courses in the same sequence, each student is asked to identify those courses they have already taken.

The list was designed by considering the course descriptions for all upper level economics courses. It was circulated and revised with discussion among the economics faculty. Some concepts are widely covered in several courses. Other concepts are addressed in a limited fashion and we would not expect all students to rank them highly.

The results from this process provide information on the student perceptions as to which topics are covered and the extent they believe they have mastered those topics. A probit analysis of the correlation between student responses and the courses taken identifies how courses build upon the student perceived competencies in economics. The faculty can then modify or change the curriculum to address any issues that arise.

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THE EFFECTS OF TAXES ON CROSS-BORDER SHOPPING WITH INTERDEPENDENT TAX REVENUE FUNCTIONS - TAX COMPLIANCE OR COORDINATION

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ABSTRACT

Although some states and national governments are considering new tax revenue sources, including lotteries and gambling, most continue to rely on adjusting their tax structures to increase tax revenues. The problem facing these states/nations is that as the tax rate increases the tax base shrinks, due to residents shopping in neighboring states or cross-border shopping. States should consider the actions of their competitors when choosing the optimal tax strategy that maximizes tax revenues.

While there is incentive for states to compete for these tax revenues by lowering their tax rates, this potentially reduces the aggregate tax revenues for a nation or a union of nations. Attention should be placed not only on the individual state maximizing revenue tax rates, but also on the unified tax revenue functions of border states.

This paper develops a model, which examines the interdependencies of state tax rates in maximizing the joint revenue function of border governments. This helps address if states should exercise tax competition or compliance? If there is tax compliance, should it be set at the minimum or a weighted-average of the tax rates? Results show that this depends on the price elasticity of demand and the size of the governmental bodies.

TOWARD A SINO-ASEAN FREE TRADE ZONE: ISSUES AND PROSPECTS

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ABSTRACT

This paper explores the implications of the proposed free-trade pact for China and the ASEAN (FTA). The following results have emerged from the analyses. First, China would be, and indeed, has been, quite interested in such a pact. As the Chinese see it, they face little risks and have much to gain from FTA. Their economic size and their technological capacity gave the Chinese such a confidence. Further, the FTA will allow China to lessen her dependence on the industrial economies. From the ASEAN's perspective, however, the view varies from one country to another. For example, while a sophisticated industrialized economy such as Singapore has a different perspective than the other poorer members, the FTA promises more hope than harm for most. For an industrializing country like Malaysia, the need to protect her emerging (automobile) industry is still strong, and such a pact may cause competitive problems. The smaller economies such as Viet Nam, the Philippines, the benefits from FTA seem to outweigh the costs because of the dynamic effects of trade. Finally, there are factors that would favor the creation of the FTA, and the prospects of such a pact appear good. The ramifications for regional and wider cooperation and stability are interesting but need time to study.

INTRODUCTION

After a preliminary agreement between Chinese and ASEAN leaders in Brunei last November, negotiations toward the creation of a Sino-ASEAN free trade zone within the next ten years start in March 2002. Given China's dominant economic position and accession to the WTO last December, her interest in such a development is understandable. After all, if the Chinese feel ready to open their door to the competition from the industrial powers, there is no reason why they should fear the economic intrusion from the smaller and weaker economies to the South. Yet, given the great disparity between them, the question is whether all ten members of ASEAN, feel the same way. What are the implications of such a creation to the ASEAN as a group and for the individual economies? In what way will China expect to gain from the proposed free-trade area? This issue is of concern not just to the future of economic relations in East and Southeast Asia. This paper examines the major issues and prospects of the proposed free trade zone for China and the ASEAN.

THE ECONOMIES OF CHINA AND THE ASEAN

The population of the ASEAN-10 in 2000 was about 40 percent of the Chinese population, and the ASEAN has a surface area just under one-half of China's (Table 1). However, the economies of the ASEAN-10 combined as measured by real GDP in 2000 are approximately 64

percent of China's. The financial meltdown in Southeast Asia in 1997 has resulted in steep declines in the GDP of the major economies like Indonesia (-13.13 GDP growth rate in 1998), Malaysia (-7.37), and Thailand (-10.77). Since then, these economies appeared to have bounced back, but by 2000, the average growth rate of the ASEAN-10 (5.41 percent) was still lower than China's (8 percent). Thus given China's higher growth rates than the ASEAN's after 1997, one can reasonably expect the difference in the economies of the two sides to increase.

Table 1
Select Indicators, ASEAN and China, 1998, 2000

Countries	Population (millions)	Surface Area (thousands) (sq. km)	GDP (billions) (USD)	GDP/Capita (USD	GDP Growth (per cent) 1998	GDP Growth (per cent) 2000
Brunei	0.31	6	4,623	14,094	-3.99	2.97
Cambodia	11	181	3,230	289	1.81	4.5
Indonesia	204	1,905	153,252	721	-13.13	4.47
Lao PDR	5	237	1,717	315	3.99	5.74
Malaysia	21	330	89,321	4,016	-7.37	8.53
Myanmar	44	677	7,083	155	5.77	6.23
Philippines	71	300	75,189	990	0.59	3.95
Singapore	3	1	92,257	25,864	0.06	9.89
Thailand	60	513	121,933	1,986	-10.77	4.31
Vietnam	78	325	31,611	396	5.83	6.75
ASEAN Total	497	4,475	580,212	1,121	-7.16	5.41
China	1239	9,561	902,000	860	7.8	8
ASEAN/ China	40.14%	46.80%	64.33%			

Source: ASEAN Secretariat (for ASEAN) and APEC Secretariat (for China)

Finally, another salient feature of the ASEAN economies is the great variation among them. This is true of size (i.e., GDP) and per capita income. The implication here is that the pattern of trade expansions and their economic impact would vary from one ASEAN country to another. Although the ASEAN has not played a prominent role in China's global trade, there are indications that the volume of China's trade with ASEAN-10 has increased at a fast rate. Data on Chinese trade can vary, sometimes substantially according to sources, but according to IMF estimates, Sino-ASEAN

trade grew five times during the 1990's, from 7,285 million in 1990 to 37,571 million USD in 2000 (Table 2). This was an impressive record of trade expansion, especially if one considers the small trade relationship (2,197 million USD) in 1982, five years after China launched her reform toward a market economy. The share of ASEAN in China's global trade, although low, has increased from 6.12 percent to 7.45 percent from 1990 to 2000.

China's recent major trading partners in the ASEAN-10 have been, in decreasing order of importance, Singapore, Indonesia, Thailand, and Malaysia. The lesser of China's ASEAN partners were the Philippines and Viet Nam. Sino-Viet Nam trade barely existed in 1990, but has shown a substantial expansion between 1995 and 2000. The said statistical evidence means that China's trade has concentrated on the more dominant economies of the ASEAN, the effects of a free trade zone will likely be more pronounced on China's major trading partners in the ASEAN than on the smaller ones.

FROM CHINA'S PERSPECTIVE

There are a number of explanations for China's enthusiasm for a FTA (Free Trade Agreement) with the ASEAN. First, with a colossal and rapidly expanding economy combined with

Table 2
China's Trade with ASEAN and Other: 1982-2000
(Millions USD)

	Exports			Imports			Total Trade		
	1982	1990	2000	1982	1990	2000	1982	1990	2000
1. Brunei	5	8			4		5	12	
2. Cambodia		3	164		3	59		6	223
3. Indonesia	46	401	3,062	151	849	4,402	197	1,250	7,464
4. Laos		14	34	7	6	6	7	20	40
5. Malaysia	191	370	2,565	156	852	3,606	347	1,222	6,171
6. Myanmar		277	496		95	125		372	621
7. Philippines	236	205	1,464	137	90	1,677	373	295	3,141
8. Singapore	648	2,016	5,761	103	849	5,060	751	2,865	10,821
9. Thailand	168	854	2,243	347	386	4,381	515	1,240	6,624
10. Vietnam		2	1,537		1	929		3	2,466
11. ASEAN Total	1,294	4,150	17,326	901	3,135	20,245	2,195	7,285	37,571
12. China World Total	21,865	64,500	249,195	18,920	54,449	255,096	40,785	118,949	504,291
13. China with Industrial Countries	9,371	21,901	140,301	13,029	26,860	106,234	22,400	48,761	246,535

Table 2
China's Trade with ASEAN and Other: 1982-2000
(Millions USD)

	Exports			Imports			Total Trade		
	1982	1990	2000	1982	1990	2000	1982	1990	2000
14. China with Developing Countries	11,783	39,294	108,208	4,331	24,291	111,565	16,114	63,585	219,773
15. China with Asia	7,222	34,523	82,860	2,540	21,204	82,723	9,762	55,727	165,583
(11)/(12)	5.92%	6.43%	6.95%	4.76%	5.76%	7.94%	5.38%	6.12%	7.45%
(11)/(13)	13.81%	18.95%	12.35%	6.92%	11.67%	19.06%	9.80%	14.94%	15.24%
(11)/(14)	10.98%	10.56%	16.01%	20.80%	12.91%	18.15%	13.62%	11.46%	17.10%
(11)/(15)	17.92%	12.02%	20.91%	35.47%	14.78%	24.47%	22.49%	13.07%	22.69%

Source: IMF, Direction of Trade Statistics Yearbook, various issues

a huge population base, the risk of losing out in economic ties with a much smaller and weaker ASEAN would be negligible. Secondly, in practice, China will not deal with the ASEAN as a unified and homogeneous group. Substantial variations in the level of development would give China an advantage mainly because, in reality, bilateral relationships are more important than multilateral commitments. Thirdly, there are good complementarities between China and the ASEAN economies. For example, the ASEAN would have access to reliable and geographically close sources of supply of many raw materials and natural resources for China's growing industrial needs. Examples include metal ores, crude oil, natural gas, timber from Indonesia and Viet Nam. The ASEAN can also supply cheap food items such as banana (Philippines), coffee (Indonesia, Viet Nam). Fourthly, ASEAN would provide good markets for Chinese exports of low-price machinery and industrial equipment, electronics, and an assortment of cheap consumer products. China, and the ASEAN also, know that is hard to beat Chinese low prices. According to some recent estimates, China's industrial costs are 30 to 40 percent lower than Indonesia (Jakarta Post, 2002). The Chinese also saw another advantage associated with the geographical proximity, which is further enhanced by the ongoing construction and expansion of rail network linking China with Laos, Cambodia, Viet Nam, Thailand, Malaysia, and Singapore.

China's did not attempt to hide her enthusiasm for the FTA when the Chinese leadership attempts to allay ASEAN's fears. For example, Chinese Vice Minister of Foreign Trade and Economic Cooperation Sun Zhengyu told an ASEAN audience that "Clearly, the advantages [of AFT with China] will outweigh the disadvantages for ASEAN"(United Press International, 2002). His arguments were that (1) FTA would reduce China's tariffs for ASEAN exports, so China's market will be more open for ASEAN trade and investment, and (2) there will be more Chinese investment in the world, including ASEAN. Another manifestation of China's interest in the FTA is her stated willingness to cut tariffs before the ASEAN states cuts theirs (a rule also informally known as "early harvest." (AsiaPulse News, 2002). Finally, one needs to mention that the FTA will allow China to lessen her dependence on the industrial economies.

To the aforementioned reasons, one should add China's ability to recycle her substantial and growing trade surplus in the ASEAN economies. According to IMF estimates, in 2000, China enjoyed a merchandise trade surplus of around 24,1 billion USD. Chinese investors would look for a business environment complementary to China's own. Such an environment should show reasonable political risks and good economics, such as a trained or trainable but low-cost labor force, fairly adequate infrastructure, and the like. The industrializing members of the ASEAN like Malaysia, Thailand, and to a lesser extend, Viet Nam and the Philippines, should make the list of candidates for Chine foreign direct investment (FDI). While Singapore has the most developed social infrastructure and perhaps the best industrial labor force but her high labor costs would present a deterrent for Chinese FDI in manufacturing. Instead, a report by Singapore's Ministry of Trade and Industry concluded that China would be more attracted to Singapore as a service hub for Chinese firms (Wall Street Journal, March 7, 2002). Indonesia, while rich in natural resources, may also present problems from the Chinese standpoint partly because of perceived high political risks. While Malaysia is also country with a dominant Muslim politics and culture, the political instability associated with the "Muslim" factor is usually seen by the outside world as a more dominant issue in Indonesia than in Malaysia.

FROM THE ASEAN 'S PERSPECTIVE

One of ASEAN's great concerns has been the continuation of the diversion of FDI from industrial nations to the ASEAN toward China. In fact, preliminary evidences indicate that diversion from the ASEAN to China has been following a disastrous course for Southeast Asia. Economists at J. P Morgan Chase and Co. estimated that the pattern of 30 percent to China and 70 percent to Asia-Pacific has been reversed in recent years, with China now accounting for some 75 percent (United Press International, 2002). Then for the ASEAN, the reason for hope is for China to recycle some of the trade surpluses generated by FDI in the emerging economies to the South.

To the ASEAN-5 (Indonesia, Malaysia, Philippines, Singapore, and Thailand), their import needs from China in the mid-1990's were concentrated on finished manufactured products classified by raw material (SITC 6) and machinery and transportation equipment (SITC 7). The above fact is generally consistent with China's global export pattern. On ASEAN's export side, the items that China has bought the most included such categories as mineral fuels, lubricating oil and related raw materials (SITC 3), and manufactured products classified by raw material (SITC 6). Thus, there has been a substantial degree of intra-industry trade between China and ASEAN-5 regarding manufactured goods under SITC 6 and 7. Thus, a major source of attraction of the FTA is the prospect of benefits associated with the economics of scale.

On the other hand, the ASEAN will be concerned with the problem of growing disparity between itself and China. As seen above, the great disparity in output and per capital income is expected to increase in the future. Integration would be easier if intra-disparity and inter-disparity can be reduced. Finally, another source of concern relates to country-specific problems such as the need to protect the emerging automobile industry in Malaysia and the Philippines' worries about her relatively weak consumer product industries.

CONCLUDING THOUGHTS

Economic integration usually makes sense from a theoretical standpoint. However, for the proposed Sino-ASEAN free trade zone to work as intended, much preparation needs to take place. Among the more urgent items on the agenda are the need to strengthen the integration process within the ASEAN-10 and to ensure that the Chinese market would be open to ASEAN products and FDI. ASEAN's fear of being left behind should not be a deterrent if national economic and industrial policy within the ASEAN can help toward ending or reducing the development gap between the two camps. There are a number of factors that would favor FTA and those include economic recovery in the ASEAN and China's recent TWO membership. The ramifications of FTA for the process of wider economic integration would appear favorable in theory, but much work remains to be done to make such a greater trade pact function to the benefit of the entire membership and the global community.

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TOURISM, DEVELOPING REGIONS, AND ECONOMIC GROWTH: AN INPUT-OUTPUT PERSPECTIVE

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ABSTRACT

Input-output analysis is a classic model of economic research of potential value when analyzing the impact of tourism upon developing regions. Here, the value of Input-Output analysis is discussed in terms of tourism strategies aimed at developing regions. When combined with more qualitative social measures of analysis as part of a more robust research agenda, Input-Output analysis has a significant role to play as developing regions plan tourism initiatives.

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EFFECTS OF INCREASED LITERACY ON WAGES IN MANUFACTURING: AN INTERNATIONAL STUDY

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ABSTRACT

This paper examines the effects of decreased in illiteracy on manufacturing wages using an international data for past three decades on illiteracy, unemployment, and manufacturing wages. Though not a much-researched topic, we find this issue important in the analysis of manufacturing wages globally. Most previous studies have primarily considered years of education completed; very few have focused on illiteracy rates. To better understand wages in the global economy today and improve them in the future, we should study the effects of literacy further.

The results suggest that illiteracy add wages were negatively correlated, as decreased illiteracy leads to higher wages. Regression analysis conducted for several of the nations resulted in incomplete conclusions. This may be attributed to unavailable data or poor reporting of statistics by national governments. Overall, the results supported the null hypothesis. We have found literacy to be a statistically significant variable in explaining changes in manufacturing wages.

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