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Product diversification and total export instability: A portfolio approach

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PRODUCT DIVERSIFICATION AND TOTAL EXPORT INSTABILITY: A PORTFOLIO APPROACH

by

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Abstract

Product Diversification And Total Export Instability: A Portfolio Approach

by

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This study provides a systematic and comprehensive analysis of the relationship between product concentration and total export instability. By employing the portfolio approach, the conventional concern about the validity of a significant relationship can be shifted to focus on the necessary condition required for the existence of this relationship. Since product concentration and total export instability are not linked mechanically, their relationship should be investigated by an indirect rather than the customary direct empirical method. By examining dynamically how product diversification can dampen total export instability, we determine the relationship between product concentration and total export instability. The conventional proposition of a significant relationship between product concentration and total export instability is strongly but conditionally supported from this study.

My sincere gratitude to

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PRODUCT DIVERSIFICATION AND TOTAL EXPORT INSTABILITY : A PORTFOLIO APPROACH

Chapter One Introduction

Studies of the relationship between product concentration and total export instability have developed along two main lines. The first is the customary statistical test conducted in either short-form including product concentration as the only explanatory variable; or the long-form, including other explanatory variables such as geographic concentration. The second is the portfolio approach examining how product diversification can minimize total export instability in order to confirm that product concentration is a diversifiable source of a nation's 'excessive' export instability.[1] As is going to be shown in this thesis, the portfolio approach is superior to the customary approach not only theoretically but also empirically.

1.1 Advantages of the Portfolio Approach

First of all, the portfolio approach represents a

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[1] 'Excessive' over the part of total export instability caused by all undiversifiable 'systematic' forces which, in turn, are defined to include all international and national forces affecting the export sector as a whole.

framework which is capable of providing a solid theoretical basis for examining the relationship between product concentration and total export instability. This relationship has been widely alluded to in the literature,[2] but has never been integrated into a theoretically consistent model. This is one of the major contributions of this thesis.

Secondly, the portfolio approach also provides a practical empirical model that allows for a statistical analysis of the relationship between product concentration and total export instability.

Thirdly, certain nations exporting very stable products may not demonstrate the expected association between product concentration and total export instability based on the customary statistical test.

Finally, the portfolio approach also provides a framework for studying issues such as optimal export composition, the impact of total export instability on economic development, and export and economic integration.

1.2 Previous Literature

Conventionally, to study the sources of export instability, one must classify them first according to the

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[2] For example, "concentration on a few products reduces a country's chances of having fluctuations in one direction in some of its exports offset or ameliorated by counter fluctuations or stability in others"[MacBean:1966, p4].

traditional framework of supply and demand[Murray:1978; Ethier :1983]. While some previous studies suggest that supply uncertainties played a dominant role[Charette:1985; MacBean & Nguyen:1987],[3] others argue that demand uncertainties were historically the main causes of export instability[Nurkse: 1958; Love:1985].[4] The problem with these studies is, as Massell(1970, p619) commented, "the absence of an explicit theoretical model explaining export instability and thereby justifying the particular assortment of explanatory variables chosen". In this study, the portfolio approach is used to address explicitly the relationship between product concentration and total export instability on a theoretical basis.

Based on either short- or long-form regression equations, previous statistical tests investigating the relationship between product concentration and total export instability have presented mixed findings from strongly supporting[Love :1986], to weakly supporting[Massell:1970], to rejecting the conventional proposition of a significant relationship[MacBean & Nguyen:1987]. In this study, the employment of the portfolio approach can shift attention from the issue of

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[3] such as production uncertainty[MacMinn & Holtman:1983], quality uncertainty[Bond:1984], and transport cost uncertainty [Ruiz-Meir:1990].

[4] such as price and demand uncertainty[Wilson & Takacs:1979], exchange rate uncertainty[de Grauwe:1988].

historical validity of a significant relationship to a focus on the necessary condition required for the existence of this relationship.

The portfolio approach has been extensively applied in the literature to study economic issues other than financial investments. This includes determination of plant design under the condition of optimal productivity flexibility[Cheng :1983], policy impacts on capital movements[Kreinin:1983], as well as effects of alternative patterns of specialization in manufacturing and the evaluation of resource reallocation [Kuznets:1971].

With regard to export fluctuation studies, the portfolio approach has been employed based on the following two general tools: the portfolio concepts, particular the concept of risk diversification[Katrak:1973];[5] and the problem-solving techniques determining the optimal export composition under the objective of minimizing total export fluctuation[Love :1979], or under a two-dimensional rule of portfolio selection [Labys & Lord:1990]. As will be explained in Chapter Two, since both portfolio problem-solving techniques are either irrelevant or inapplicable in this study, only basic portfolio

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[5] as it can also be interpreted as the possibility to diversify the portfolio's risk or instability by adding more portfolio members -- a definition in the context of the textbook portfolio approach in any standard financial textbook instead of the traditional Markowitz portfolio approach [Markowitz:1952].

concepts will be employed in this thesis to study theoretically as well as empirically the relationship between product concentration and total export instability.

1.3 The Portfolio Approach and the Export Sector

The portfolio approach was first extensively applied in financial studies. Since there are distinct differences between the export sector and a financial market such as the stock market, some explanations should be offered in order to justify the employment of the portfolio approach in the present context.

First, usually there is no specific constraint on the composition of a stock portfolio; whereas in the export sector, there are constraints on both eliminating certain member industries and introducing a new one. This is because some existing primary or strategic industries may be protected on a political or an economic basis, and a new industry promoted by state planners may not lie within the nation's set of potential comparative advantage. Therefore, in general, we can obtain an unconditional optimal stock portfolio but only a conditional optimal export portfolio. Nevertheless, as will be demonstrated in Section 2.2.1, the portfolio approach is applicable under either situation.

Second, while viewed within a two-dimensional growth-fluctuation framework, products of the same category exported from different countries may still be treated as different products in the world trade market. This is because, other than physical differences in material quality and production cost, they can also be characterized by different types of product-specific impacts as well as nation-dependent systematic impacts affecting their earning fluctuations. Therefore, the cost of building an identical new industry will in general not be the same for all interested nations. However, as will be explained in Section 2.1, this cost consideration will not invalidate the employment of the portfolio approach in export studies, since the paradigm utilizes common objectives but not necessarily common portfolio members.

Third, the portfolio approach is absolutely complementary to the principle of trade comparative advantage. If studying export cost-profit data, we can certainly advance the concept of trade comparative advantage into a two-dimensional growth-fluctuation sense by employing the portfolio approach.

While the principle of trade comparative advantage has been applied to answer the orientation of one nation's individual export products, the portfolio approach can be utilized to manage the development of the export sector as a whole. Therefore, it is export earning data rather than export cost-profit data which will be analyzed in this study focusing on a management issue of minimizing total export instability. Furthermore, while the principle of trade comparative advantage can hardly be applied to cope with some export-related issues such as the environmental problems, the portfolio approach can always be reasonably extended to deal with issues regarding the nation's general welfare.

1.4 Organization of Chapters

Chapter Two pursues the issue of the applicability of the portfolio approach to export fluctuation studies. Chapter Three provides a theoretical link between product concentration and total export instability by employing the portfolio approach.

In Chapter Four, an indirect empirical approach will be recommended in order to manage the fact that product concentration and total export instability are not linked mechanically.

The empirical results will be presented and discussed in Chapter Five. Based on the test results, the conventional proposition of a significant relationship between product concentration and total export instability is found to be supported but only conditionally.

Chapter six presents the conclusions. It is believed that, under the two-dimensional growth-fluctuation framework, the portfolio approach has great potential to serve as a policy-relevant framework dealing with export-related issues.

Chapter Two The Portfolio Approach For Export Fluctuation Studies

The basic portfolio concepts and problem-solving technique have found wide acceptance in export fluctuation studies during the last two decades. In this chapter, their applicability in this study will be examined.

2.1 Basic Portfolio Concepts

The portfolio approach emphasizes risk-diversification. By utilizing this risk-diversification framework, we can assume that all international and national disturbances or, in academic jargon, all 'systematic' impacts affecting the export sector as a whole are undiversifiable and only 'product-specific' (or 'individual') impacts are diversifiable for the export sector. Accordingly, 'product diversification' will be deemed as the direct solution to diversify all 'product-specific' impacts in the export sector.

In general, there may always exist several alternative ways of defining a national export portfolio.[6] For instance, referring to the Standard International Trade Classification (SITC) system, the nation's export portfolio can be defined as composed of all its one- or two-digit SITC product categories

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[6] whereas the stock market is usually defined as a stock portfolio composed by all individual common stocks.

and so on, but rarely a combination of different product categories drawn from different SITC levels. As this requirement of specification is a necessary condition to ensure informational clarity for an export portfolio, it will be further explained in the following.

As an example, if viewing the SITC system as a consistently designed export information structure, then a typical force affecting only a certain one-digit SITC product category is clearly 'individual' from the perspective of this product category but not from the perspective of two- or three- digit products listed under this one-digit SITC product category. Therefore, if we were to define an export portfolio composed of different product categories drawn from different SITC levels, we would be unable to distinguish between 'systematic' and 'individual' impacts causing export fluctuations.[7]

As indicated by Srinivasan(1988), the portfolio approach must stay in the domain of neoclassical paradigm within the discipline of acquiring an optimal equilibrium. This certainly implies that there must exist a 'common objective' which will be attained by state planners while constructing an optimal export portfolio. Under a growth-fluctuation

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[7] this is especially important when we want to assume that 'individual' impacts are diversifiable and 'systematic' impacts are undiversifiable.

framework, such a 'common objective' is typically expressed as either maximizing the export portfolio's growth rate or minimizing the export portfolio's fluctuation, or a more generalized two-dimensional one combining the above two.

2.2 Problem-Solving Techniques

In the literature, the portfolio problem-solving technique has been employed to determine the optimal scheme of export resource allocation under the objective of minimizing total export instability. However, its applicability for the related task of minimizing export product concentration remains to be verified.

2.2.1 One-Dimensional Optimal Solution

In general, the task of determining an export portfolio under the objective of minimizing total export instability subject to a unity condition on the sum of all products' earning weights (expressed mathematically as $\Sigma s_i = 1$) and all non-negative weights s_i has been treated as a 'quadratic programming problem'[Labys & Lord:1990, p266].[8] It can be set up as:

$$\text{Minimize } I_X \quad \text{s.t. } 1 = \sum_{i=1}^{n} s_i \text{ and } s_1 \geq 0, \ldots\ldots, s_n \geq 0 \quad (1)$$

[8] However, as mentioned in section 1.3, if encountering more stringent constraints, then we have to set $s_i \geq a_i$, $0 < a_i < 1$ for those irreplaceable primary or strategic industries.

In this equation (1), I_X is the conventional measure of total export instability which is expressed as[Massell:1970; Love :1981; MacBean & Nguyen:1987, CH4]:

$$I_X = \sum_{i=1}^{n} \sum_{j=1}^{n} s_i \, s_j \, I_{ij} \qquad (2)$$

where n is the total number of export products with each having a share of s_i or s_j in total export earnings at the beginning of the investigation period, and I_{ij} denotes the instability-correlation values or, in other words, the detrended variance-covariance values between products i and j.

For the purpose of understanding the composition of each optimal earning weight s_i, we can simplify the above equation (1) into the following Lagrangian equation:[9]

$$L = \min_{s_1,\ldots s_n,\alpha} \; I_X + \alpha\left(1 - \sum_{i=1}^{n} s_i\right) \qquad (3)$$

All first-order conditions obtained by evaluating this Lagrangian equation (3) with respect to each product's earning weight s_i and the Lagrangian multiplier α can be listed as:

$$\frac{\partial L}{\partial s_i} = 2\left(s_i I_{ii} + \sum_{\substack{j=1 \\ j \neq i}}^{n} s_j I_{ij}\right) - \alpha \qquad \forall \; i=1,\ldots, n \qquad (4a)$$

$$\frac{\partial L}{\partial \alpha} = 1 - \sum_{i=1}^{n} s_i \qquad (4b)$$

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[9] which, in turn, can also be deemed as the 'unconditional' form for solving, for example, an optimal stock portfolio with short-sale allowance.

By setting each of the n+1 individual lines in both equations (4a) and (4b) to equal zero, we have created a complete system capable of solving n unknown optimal product earning weights plus the unknown Lagrangian multiplier.

Based on the Love(1979) study including only one primary product and one manufactured product, since the solution of each optimal product earning weight is composed of nothing but product instability-correlation information, there is no guarantee that a set of optimal product earning weights minimizing total export instability can also achieve a minimum degree of export product concentration.[10] Therefore, as will be further explained in Chapter Four, since we are here interested in examining the conventional proposition of a significant relationship between total export instability and production concentration, this problem-solving technique in equation (1) is deemed inapplicable in this study.

2.2.2 Two-Dimensional Optimal Solution

The above portfolio problem-solving technique has also been advanced in recent years to accomplish a more generalized (two-dimensional) objective of maximizing growth plus

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[10] Mathematically, a minimum degree of product concentration will usually require a quite balanced scheme of resource allocation in the export sector. Obviously such a balanced scheme can not be guaranteed to also minimize total export instability.

minimizing fluctuation in constructing an optimal export portfolio.

While investigating short-term (expected) export growth rates and export risk, Labys and Lord(1990) have drawn the efficient frontier of risk and return for the sample commodity portfolios. The following Figure 1a illustrates this concept of efficient frontier line with a few modifications.[11] First, the efficient frontier has been extended to cross over the horizontal risk axis, since we can not rule out the possibility that the whole export sector or some individual products can experience no or negative growth.[12] Second, the origin is shown in the picture in order to demonstrate the rule of portfolio selection in Labys and Lord(1990).

. Figures 1a & 1b (on next page) .

The portfolio's 'risk-return' ratio is the rule of portfolio selection in Labys and Lord(1990), and the standard is that the smaller this ratio the better. However, as an example, in the above Figure 1b, the inverse of portfolio a's 'risk-return' ratio is exactly its tangency value measured with respect to the origin. Therefore, this rule of portfolio selection can also be interpreted as that the greater the portfolio's tangency the better.

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[11] Labys & Lord(1990, p271).

[12] especially when they are investigating *short-term* (expected) export growth rates.

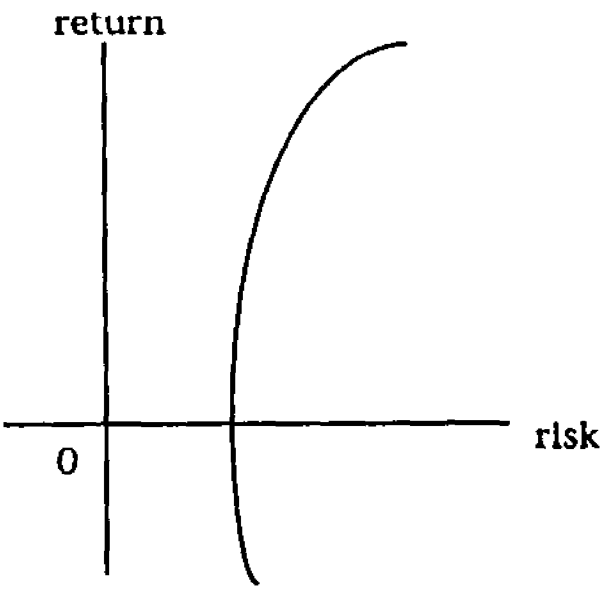

Figure 1a.

Efficient frontier line

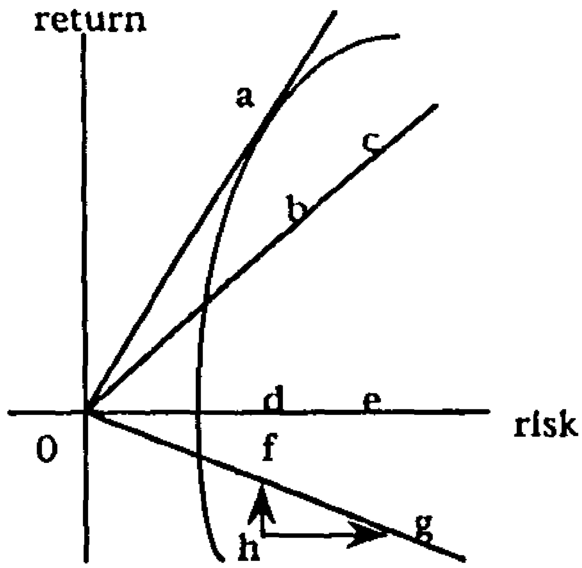

Figure 1b.

Optimal export portfolio

Initially, this 'risk-return' ratio must be calculated relatively with respect to the origin.[13] The question will then come down to the justification of the origin, since it now serves as the 'common basis' in the measurement of every portfolio's tangency. So far, it remains unanswered. Furthermore, if the origin could indeed be rationalized, then the previous setup in equation (1) could be changed directly from minimizing the portfolio's instability into maximizing the portfolio's tangency to accomplish the more generalized two-dimensional objective.

Second, according to the rule of portfolio selection in Labys and Lord(1990), identical 'risk-return' ratios or tangency values for, for example, portfolios b and c in the above Figure 1b will mean identical rankings. However, in the same figure between portfolios d and e right on the risk axis, this rule will be inapplicable, since portfolio e is absolutely inferior to portfolio d which has a relatively smaller risk, while both are having an identical zero growth rate. As an another example, relatively speaking, in the same figure, we can easily observe that portfolio h is inferior to portfolio f but is superior to portfolio g. However, both portfolios f and g would be shown to have equivalent rankings according to this rule. Therefore, this more sophisticated

[13] Obviously, it is the statistical measure of 'coefficient of variation'.

two-dimensional approach, though clearly superior to the simplistic one in the previous section, is still found to be unsatisfactory for our needs.

2.3 Summary

Conditionally or unconditionally, an optimal export portfolio under the specific objective of minimizing total instability can always be determined by employing the general portfolio's problem-solving technique.

Eventually, under a two-dimensional growth-fluctuation framework, a truly optimal export portfolio should be capable of achieving simultaneously both objectives of maximizing growth and minimizing fluctuation. However, in order to determine a two-dimensional optimal export portfolio, we need to employ a two-dimensional rule of portfolio selection which, so far, has not been perfectly designed.

In order to examine the conventional proposition of a significant relationship between product concentration and total export instability, we face the additional concern of minimizing product concentration while minimizing total export instability. While this relationship can not be satisfactorily studied by applying the portfolio's problem-solving techniques, it can still be studied theoretically as well as empirically in the following chapters by using basic portfolio concepts.

Chapter Three Total Export Instability And Product Concentration

Conventionally, total export instability is defined as the detrended variability of a set of time-series total export data[e.g. Scandizzo & Diakosawas:1987]. However, in order to satisfactorily deal with the related concern of minimizing product concentration, we need individual product information in the composition of total export instability. Therefore, total export instability will have to be calculated according to equation (2) (on page 11) based on individual product information rather than total export information.

3.1 Data Availability Problems

Two data availability problems plague customary statistical export fluctuation tests in this area. The first relates to the nature of the instability measure; and the second concerns the imperfection of projected export information, hence the unavailability of short-term export fluctuation measures.

By nature, an export instability index is only one figure for the entire data set used in its measurement.[14]

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[14] without considering innovative instability indices such as the five-year weighted average instability measure [MacBean:1966] or individual annual detrended deviations as short-term instability measures[Love:1986].

Accordingly, Love(1985, p244) commented that "the statistical technique typically used to investigate the causes of earnings instability is cross-country regression analysis." Since our interest is to investigate the relationship between product concentration and total export instability *within the nation*, we may have to consider a new empirical method.

Next, efforts to apply econometric models to forecast export earnings for traditional commodities can be found in recent years[Lord & Boye:1987]. However, before the forecasting technique can be perfectly available, conservatively, we will only utilize actual export time-series data to study empirically export instability.

3.2 Different Instability Indices

Based on their extensive studies, Lin and Ho(1979, p184) point out that "since amplitude, duration, and irregularity of fluctuations vary from one commodity to another, it is difficult to capture different aspects of variability by any single measurement". Therefore, it is not surprising to see that more than a dozen different innovative instability indices have been recommended in the past.[15] However,since "the various indices of instability are essentially summary

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[15] A quite complete survey on different export instability indices can be found in Scandizzo and Diakosawas(1987, CHIII).

statistics of deviations from time trend over some period" [Love:1985, p245], there may be a convenient way to simplify the measurement of an instability index.

3.2.1 A Useful Measurement Simplification

First, Massell(1970, p619) indicated that "countries tend to plan in terms of the growth rate, not in terms of absolute increment." Based on this understanding, we believe that using export growth rates rather than earning data to measure an instability index should allow for more meaningful policy implications.

Second, many studies suggest that exponential trends can best describe long-term growth patterns in export time-series data sets[Cappock:1962; Massell:1970]. Our use of export growth rate information to measure export instability not only can make our results easily and directly comparable to this literature but also can avoid the minor irritant associated with the cumbersome double-transformation process for the purpose of normalizing an exponential trend in order to measure an export instability index.[16]

If each unit of export growth rate can be expressed as

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[16] The double-transformation process is first to standardize the original export earning data into the logarithmic form hence a set of normally distributed outcomes, and then to take anti-log transformation after the measurement.

one plus the actual growth rate and if the sample data set is sufficiently large,[17] then it is highly possible to assume directly a linear trend to describe the long-term growth pattern in the data set. The evidence from this study can show that only rare exceptions having an extreme 'V' trend in the 'China' data set can cause difficulty to this idea of measurement simplification.

3.2.2 Innovative Instability Measure

The use of individual annual residuals or, in other words, annual detrended deviations in export time-series data, as estimators of 'short-term' instability has been suggested in the literature[Love:1986; MacBean & Nguyen:1987]. The validity of this innovative instability measure has been strongly questioned by Massell(1990, p146): "a large deviation would not, by itself, imply instability. Only if there was a continuing pattern of large deviations would a country's exports be considered unstable."

Several other objections can also be raised to this innovative instability measure. First, the role of the conventional 'short-term' export risk must be justified before this 'short-term' instability measure can be introduced. Second, in economic planning, what really troubles state

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[17] in our case, twenty-five annual export growth rates for each product category.

planners is not the deviation between the projected mean export earning and its trend value but the uncertainty of knowing what the actual outcome will be.[18] Therefore, to treat an annual residual as a short-term estimator of export instability will require us either to further rationalize the existing short-term export risk measure or to modify our general concept regarding economic planning.

3.3 Other Variables

A few variables other than the instability measure will also be inspected in this study. First, the variable of long-term export growth rate will be calculated according to the following equation:

$$R = \text{antilog}\{(\log x_T - \log x_1)/(T - 1)\} \qquad (5)$$

where x_T and x_1 are respective last and first sample export earnings for each product category or for the whole export sector.

Next, conventionally, the Herfindahl coefficient[Kelly: 1981] or the Gini-Hirschman coefficient[Massell:1970; Michaely :1984] is adopted to represent a nation's degree of export product concentration. To be consistent with the notation in the total export instability measure in equation (2), the former has been calculated as:

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[18] particularly the possibility of falling below the projected level.

$$C_t = \sum_{i=1}^{n} s^2_{it} \qquad (6)$$

where s_{it} is the product #i's share of total export earnings at the beginning of the investigation period, and the latter is treated as the positive squared root of the former.

It has been suggested that, in addition to the above two coefficients, a simple index of export product concentration should also be obtained during the empirical studies, and it will be calculated according to the following equation:

$$SC = \sum_{i=1}^{k} s_i \qquad (7)$$

In this equation (7), if k equals 1, then the simple index (SC) will just represent the top product category's share in total export earnings; if k equals 28, which is the total number of two-digit SITC product categories to be investigated in this study, then it will exactly equal unity. By utilizing this simple product concentration index, we can evaluate comparatively the efficiency of using export resources under the objective of minimizing total export instability.

3.4 Product Concentration

The whole nation's economy can be defined as a portfolio composed by all economic sectors including the export sector. In the export sector, under the condition of perfect diversification of all 'product-specific' forces, total export instability will be caused only by all undiversifiable 'systematic' forces. Collectively, the 'impacts' of total export instability on all non-export sectors, and hence the whole nation's economy, can then be interpreted as the part of all 'systematic' forces causing total export instability.[19]

If the task is to diversify altogether all 'product-specific' forces in the export sector, then certainly it is not necessary for state planners to identify each 'product-specific' force to be either supply- or demand-oriented. Since product diversification is the direct solution to diversify all 'product-specific' forces according to the portfolio approach, we can therefore view the antonym of 'product diversification', which is 'product concentration', as the integrated source representing all undiversified 'product-specific' forces causing the 'excessive' export instability.

3.5 Summary

After classifying all forces affecting the export sector into one set of all undiversifiable 'systematic' and the other set of all diversifiable 'product-specific' impacts, under the condition of perfect diversification of the latter, the former

[19] Based on this understanding, all 'systematic' forces can serve as the link between both sides of 'impacts' and 'causes' of total export instability.

is perfectly related to the 'impacts' of total export instability influencing all domestic markets. Technically, by assuming the former as given, we can then conveniently deal with the latter.

According to our understanding about the portfolio's basic concepts illustrated in Section 2.1, since 'product diversification' is the direct solution to resolve the nation's 'excessive' export instability, its antonym of 'product concentration' will be treated as the integrated source representing all undiversified 'product-specific' forces causing the 'excessive' export instability.

Generally speaking, "export shortfall is damaging [and] will have two main effects: pressure on the balance of payments and a downward multiplier effect on income and expenditure"[MacBean & Nguyen:1987, pp150-1]; while upward surges in export earnings may cause inflation and currency appreciation problems for the domestic economy[Krudsen & Parnes:1975, CH1]. Therefore, export instability should be treated as only a generalized measure for empirical studies, since it can not be specified to describe only the part of negative deviations falling below the long-term growth trend. As Lawson and Theobald(1976, p275) pointed out, "one possible fruitful line of inquiry would be to take account of negative deviations, but to ignore positive ones." However, up to this date this has not been done.

Chapter Four Design An Indirect Empirical Method

The compositions of both variables of product concentration and total export instability are explicitly expressed in equations (2) and (6), respectively. At first sight, it seems there may exist a certain type of mechanical link between them, especially when product concentration is treated as the 'cause' and total export instability as the 'consequence'.

4.1 Indirect Mechanical Relationship

After separating the composition of total export instability equation (2) into two different sets of product earning weights ($s_i s_j$) and product instability-correlation values (I_{ij}), we may easily verify that, due to the non-linear compositions in both equations, the Herfindahl coefficient (C) in equation (6) can not be directly specified from this equation (2). While this clearly indicates that both variables of product concentration and total export instability are not related mechanically, it is believed that an indirect rather than a direct empirical method, as will be further explained in the following section, would be more appropriate to investigate this indirect relationship between product concentration and total export instability.

4.2 The Indirect Empirical Method

In this study, the indirect research method will be designed, first, to affect both variables of product concentration and total export instability by the same export policy, and then, to study their relationship after obtaining a series of outcomes as the consequences of policy manipulations. This will require the determination of a set of specific export policies to be utilized in the process of policy manipulations. Under the purpose of examining the conventional proposition of a significant relationship between product concentration and total export instability, the target of policy impact will have to be set to involve both product concentration and total export instability, and the criterion of policy selection will be set as the policy's ability to minimize *simultaneously* both variables.

4.3 Policies to Combat Total Export Instability

Since the composition of total export instability can be separated into product earning weights and product instability-correlation values, policy implications to combat total export instability should also be drawn accordingly to deal with both.

First, for national 'stabilization policies' effecting most likely the part of product instability-correlation values in the measure of total export instability in equation (2), while they can be further classified into the following four devices: marketing boards, stabilization funds, export duties, and variable exchange rates[Michaely:1962], it is clear that each of these devices may succeed in minimizing total export instability, but will rarely succeed in affecting product concentration. For example, in some studies, exchange rate policies have also been termed as 'mean-preserving' stabilization policies[Krugman:1991]. Therefore, since they fail to satisfy the criterion of policy selection listed in the previous section, this category of 'stabilization policies' will be deemed inapplicable in this study.

Second, while dealing with the part of product earning weights in the measure of total export instability, a typical 'resource switch' policy will look for an optimal scheme of resource allocation under the objective of minimizing total export instability in the 'existing' export sector[Love: 1979].[20] However, as has already been demonstrated in section 2.2.1, this category of resource switch policies also can not satisfy the criterion of policy selection, since it can rarely satisfy the concern of minimizing product concentration. In the end, only the category of 'product diversification' policies can be utilized by introducing new

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[20] that is, to obtain an optimal scheme of resource allocation by shifting current resources only among the existing product categories.

product categories to examine policy impacts on both product concentration and total export instability at the same time, while keeping the original relative condition of resource allocation intact[Labys & Lord:1990].

4.4 Initial Export Condition

For each sample nation, before policies of product diversification can be actually implemented in the simulation test, an 'initial' export condition involving problems of both severe product concentration and high total export instability will have to be addressed first in order for the test to be meaningfully performed. For simplicity, the idea in this study is to choose the top product category with the largest export earnings at the beginning of the investigation period to represent the 'initial' export condition for each sample nation.[21]

The process of policy manipulations will be conducted by adding in sequence one new product at a time according to the selection criterion inscribed in the policy, which is the product's effectiveness to minimize total export

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[21] This idea can also be found in Labys and Lord(1990). However, their goal is to solve the two-dimensional optimal export composition rather than to inspect policy impacts on both product concentration and total export instability. Detailed discussions have been provided in Section 2.2.2.

instability.[22] Since there is no fixed pattern in determining the new best product which can minimize most effectively total export instability at each time, we will have to perform similar evaluations with a decreasing number of available new products at each stage until the actual export condition can be revealed.[23]

4.5 Summary

Since product concentration and total export instability can not be shown to be related mechanically, their relationship must be investigated by an indirect empirical method. The indirect empirical method has been designed by allowing both product concentration and total export instability to be affected by the same policy of product diversification.

However, before the recommended indirect method can be applied, an 'initial' export condition for each sample nation must be defined to address the prerequisite condition of experiencing both problems of total export instability and

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[22] while minimizing product concentration is automatically guaranteed by the nature of the policy.

[23] Obviously, for the job of product evaluations there is no need to identify each new product's correlation coefficient with the original export condition, since the new product's instability is also an important element to determine the new total export instability, especially before the stage of perfect diversification of product-specific impacts can be reached.

product concentration. Although our approach in determining each sample nation's 'initial' export condition may be considered somewhat conservative, nevertheless it satisfies the purpose of this study.

Chapter Five Data Collection And Empirical Studies

The SITC system (1960 revision) can be described as composed of 10 sections (one-digit code), 52 divisions (two-digit code), 150 groups (three-digit code), and 570 items (five-digit code). For the purpose of minimizing total export instability, the three-digit product groups are too disaggregate, since product groups that are not distinctly different from each other will be classified into different categories.[24] Also the detection of policy impact can become a problem especially for those product groups whose export earnings are too small to contribute a significant effect of minimizing total export instability. On the other hand, a total number of 10 one-digit product sections may be too few to achieve effectively the objective of minimizing total export instability.[25] Therefore, the classification of 52 two-digit product divisions will be accepted as a proper level of sample aggregation for this study.

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[24] For example, between 011(Meat-fresh, chilled, frozen) and 012(Meat-dried, salted, smoked), or between 677(Iron and steel wire, excluding rod) and 678(Iron and steel tubes, pipes), etc.

[25] In stock investment studies, a stock portfolio must contain around twenty different common stocks in order to achieve almost perfectly the benefit of risk-diversification [Fama:1976]. If a similar situation can also apply in the export sector, then a total number of 10 one-digit product categories may be insufficient for a perfect diversification of total export instability.

5.1 Data Collection[26]

Although a sample of only nine Asian LDCs will be investigated in this study, they can already cover quite well the range of classifications of nations based on trade orientation defined in the World Development Report(WDR) (1987).[27] They include the first three categories of 'Strongly Outward Oriented' including, in this study, Hong Kong, Korea (Republic of), Singapore and Taiwan; 'Moderately Outward Oriented' including Malaysia and Thailand; and 'Moderately Inward Oriented' including Indonesia and Philippine. While only China has not been classified in this Report, it can probably be suggested as a 'Moderately Inward Oriented' nation.

5.2 'Initial' Export Conditions

Since not all twenty-seven two-digit product divisions may contribute to the objective of minimizing total export

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[26] The data set is taken from O.E.C.D. Series C Trade by Commodities.

[27] Other than the least interested category of 'Strongly Inward Oriented', they are, 'Strongly Outward Oriented', in which trade control is either nonexistent or very low; 'Moderately Outward Oriented', in which the overall incentive structure favors the production of exports; and 'Moderately Inward Oriented', in which the overall incentive structure favors the production for the domestic market[WDR:1987, p82].

instability,[28] we should be able to observe a 'minimum' total export instability for each sample nation during the simulation test. Although the simulation test will not be discussed until the next section, for convenience, the test results regarding 'minimum' total export instability obtained will still be referred to in this section.

The 'initial' export condition information and the 'minimum' total export instability for each sample nation will be listed in the following Table 1.[29] Except for the case of Hong Kong showing an extremely low 'initial' export instability, it is clear that, comparing to the 'minimum' total export instability listed in the same table, the prerequisite condition of a high total export instability can be satisfactorily addressed by the hypothesized 'initial' export condition for each sample nation.

. Table 1 (on next page) .

First, as suggested, the deviation between the 'initial' and 'minimum' export instabilities will be defined as the nation's 'excessive' export instability caused by all undiversified 'product-specific' impacts.

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[28] the incompleteness of the data set disallows us to investigate all fifty-two two-digit product divisions.

[29] In the table, the 'initial' export instability for China has not been misrepresented, because of an extreme V-type growth trend shown in its '67' (steel) product division.

Table 1. 'Initial' export condition information and minimum total export instabilities

	CH	HK	ID	KO	MA	PH	SI	TA	TH
I. 'initial' export condition:									
A	67	84	55	63	68	63	84	63	68
SC	19.5%	41.1%	36.3%	27.3%	94.6%	44.3%	31.4%	28.2%	69.1%
R	1.319	1.372	1.203	1.110	0.998	1.163	1.580	1.359	1.152
INS	4,397	0.250	3.174	3.292	1.228	2.218	2.845	2.050	6.012
II. minimum total export instability:									
INS*	1.354	0.188	1.780	0.810	0.738	0.648	1.682	0.658	3.470

Ch=China; Hk=Hong Kong; ID=Indonesia; KO=Korea; MA=Malaysia; PH=Philippine; SI=Singapore; TA=Taiwan; TH=Thailand.

A = the 2-digit SITC code.
SC = the share in total export earnings.
R = the long-term average growth rate.
INS = the export instability.
INS*='minimum' total export instability obtained during the process of policy manipulations.

Next, the fact of obtaining different 'minimum' total export instabilities for different sample nations in the table also requires some explanations. Referring to the discussion provided in Section 2.1, under the condition of perfect diversification of all 'product-specific' impacts, one nation's 'minimum' total export instability is caused by one set of global 'systematic' impacts and another set of nation-specific 'systematic' impacts. Therefore, different national economic conditions can result in different 'minimum' total export instabilities.

5.3 Simulation Tests

The simulation test can also be deemed as the process of policy manipulations. It will be conducted by adding in sequence one selected new product at one time to the 'initial' and therefore the 'original' export condition later on.

Based on the illustration provided in Section 4.4, the best new product at each time will be selected based on the criterion of minimizing most effectively total export instability. However, since there may not exist any consistent pattern in determining the best new products, we will have to evaluate repeatedly the performances of all available candidates and select the best one at each point of time.

The case of Taiwan will be exemplified in Table 2 in the

Appendix section (from pages 55 to 57) to demonstrate how this job of product evaluation and selection is performed. As this job will be started with twenty-seven instability measurements by adding in turn each new product division into the Taiwan's hypothesized 'initial' export condition, in the table, the first best new product division selected is the product category of '84'. Repeatedly, this job of product evaluation and selection will not be finished until the instability of the 'actual' export condition including all twenty-eight product divisions can be presented in the end of the table.

Accordingly, the simulation test will be conducted based on the determined product list for each sample nation. All the information of total export instability (INS) measured in equation (2), long-term mean export growth rate (R) measured in equation (5), the Herfindahl coefficient (C) measured in equation (6), and the suggested simple index of product concentration (SC) measured in equation (7) obtained at each stage during the simulation test for each sample nation will be presented in Table 3 and Chart 1 in the Appendix (from pages 58 to 66).

5.4 Regression Analyses

Based on the simulation results, the relationship between product concentration and total export instability can now be examined. A simple regression analysis will be conducted to examine this relationship while keeping product concentration as the 'cause' and total export instability as the 'consequence'.[30]

No critical difference was found between either set of regression results with respect to the Herfindahl or the Gini-Hirschman coefficient as the explanatory variable, respectively. Therefore, for simplicity, only results obtained with respect to the Herfindahl coefficient will be provided in the following Table 4 under the sub-title of 'Type I' test, which means 'under the objective of minimizing total export instability'.

. Table 4 (on next page) .

In the table, only Hong Kong has been shown to be statistically insignificant. Referring to Table 1, since Hong Kong's major export, 'clothing', is extremely stable, there may only exist very few new products which can contribute to the objective of minimizing total export instability. As Table 3 for the Hong Kong case shows (on page 59), among all twenty-seven available product categories only about ten of them occupying around 25% of total export earnings can contribute to the objective of minimizing total export instability. Therefore, it may not be meaningful to

[30] Obviously, there is no need to further assume that all other things are equal here, since all 'systematic' forces have already been treated as given from the very beginning.

Table 4. Regression analyses for all sample nations

regression equation: $INS = b_0 + b_1 C + e$

	<Type I>			<Type II>		
	b_0	b_1	F	b_0	b_1	F
CH	-831.3 (-6.74)[a]	4,347 (9.96)[a]	99.2[a]	-292 (-1.11)	1,052 (2.08)[b]	4.32[b]
HK	0.213 (15.1)[a]	-0.025 (-0.85)	0.72	0.249 (49.1)[a]	-0.008 (-0.80)	0.64
ID	1.257 (13.9)[a]	1.778 (8.24)[a]	67.9[a]	2.803 (4.44)[a]	3.594 (3.38)[a]	11.4[a]
KO	0.211 (3.08)[a]	2.719 (12.3)[a]	151[a]	0.153 (0.73)	3.199 (7.33)[a]	53.7[a]
MA	-1.483 (-3.73)[a]	2.454 (5.66)[a]	32.1[a]	-2.895 (-5.56)[a]	3.993 (7.28)[a]	53.0[a]
PH	-0.347 (-2.54)[b]	2.418 (8.49)[a]	72.0[a]	0.406 (8.41)[a]	1.840 (21.9)[a]	481[a]
SI	1.629 (12.5)[a]	0.473 (1.75)[c]	3.1[c]	3.023 (10.2)[a]	0.946 (1.72)[c]	2.96[c]
TA	0.306 (6.84)[a]	1.486 (10.9)[a]	119[a]	0.407 (9.11)[a]	1.448 (14.5)[a]	210[a]
TH	0.715 (12.2)[a]	5.231 (50.2)[a]	2,516[a]	0.565 (2.93)[a]	5.586 (22.8)[a]	522[a]

Type I: under the objective of minimizing total export instability.
Type II: under the objective of maximizing total export growth rate.

F = *F*-statistics.
t-statistics are in parentheses below coefficient estimates;
a, b, c: significant at least at the respective 1%, 5%, 10% level.

investigate the relationship between product concentration hence product diversification and total export instability in Hong Kong, when its total export instability is already exceptionally low.

Among all sample nations, Hong Kong may be seen as a unique case, since it is a particularly free trade market and therefore is free of the disturbance of 'systematic' impacts on the national level during the investigation period. In other words, under the condition of perfect diversification of 'product-specific' impacts, only international 'systematic' impacts may come to affect Hong Kong's total export instability.

5.4.1 Conditional Support to the Conventional Proposition

Overall, excluding the unique exception of Hong Kong, based on the regression results in Table 4, the conventional proposition of a significant relationship between product concentration and total export instability has been strongly supported from this study. However, this support is only a 'conditional' one rather than the 'unconditional' one in the literature. This is because, in Chart 1 provided in the Appendix, the total export instability (INS) curve is reversing its trend after reaching its minimum point in every case. Therefore, the conventional proposition is supported only up to the point where an efficient degree of product diversification to minimize total export instability is achieved.

5.4.2 The Dynamic Approach

Since Malaysia is exporting a quite stable major product during the investigation period, its high degree of product concentration does not associate with a high total instability. Obviously, this case will cause difficulty to the above mentioned conventional proposition which also indicates a strong association between a high total export instability and a high degree of product concentration.

Since only the nation's 'excessive' export instability is actually related to product concentration representing all undiversified 'product-specific' impacts, it is not necessarily true that a high total export instability has to be associated with a high degree of product concentration.[31] Furthermore, as the name implies, 'product-specific' impacts are just product-specific; therefore, it is also not necessarily true that a high 'excessive' export instability has to be associated with a high degree of product concentration. Accordingly, the question should become that whether the nation's 'excessive' export instability can be diversified by improving its degree of product

[31] when nation-specific 'systematic' impacts may cause very significantly total export instability.

diversification, and obviously it can not be satisfactorily answered by employing the customary statistical regression tests.

The employment of the portfolio approach will investigate the interaction between product diversification and total export instability in order to determine the relationship between product concentration and total export instability. As long as the nation's 'excessive' export instability is not too mild and can become a policy concern, this relationship between product concentration and total export instability can be significant.

5.4.3 Performance Evaluations

For all sample nations, although their total export instability (INS) curves in Chart 1 can all be observed to level off before the end of the simulation tests, this does not necessarily imply poor investment planning in their export sectors. This is because the corresponding long-term average export growth rates rarely deteriorated at the end of the simulation tests. Collectively, this findings should only be interpreted as supporting the thesis that export resources have not been efficiently allocated under the limited objective of minimizing total export instability.

Furthermore, while summarizing the optimal results from Table 3 into the following Table 5 under the sub-title of

'Type I', which are the results obtained at the turning point of the total export instability curve for each sample nation, clearly, the 'Strongly-Outward-Oriented' nations as a group have the smallest SC value. This fact suggests that, compared to the other nations in our sample, these nations on average, when allocating export resources, did not pursue the specific objective of minimizing total export instability. In all probability these nations' aggressiveness in pursuing export expansion was consciously carried out at the cost of raising their total export instabilities.

. Table 5 (on next page) .

However, comparing to following Table 6 showing the actual export conditions,[32] we can see that this cost was not too high. Furthermore, while the information in this Table 6 can show that those 'Strongly-Outward-Oriented' sample nations as a group have an absolutely dominant performance over that of the other two groups, this findings should strongly support the conclusion stated in Balassa(1981) that, in general, countries applying outward-oriented development strategies tend to have a superior performance in terms of exports, economic growth, employment, product diversification and total export instability.

. Table 6 (on page 44) .

[32] also summarized from Table 3.

Table 5. Optimal conditions obtained in the simulation tests

		SC	R	INS
I. Strongly Outward Oriented:				
Hong Kong	<Type I>	0.663	1.358	0.188
	<Type II>	0.791	1.392	0.242
Korea(Republic of)	<Type I>	0.936	1.710	0.810
	<Type II>	0.705	1.854	1.070
Singapore	<Type I>	0.527	1.678	1.682
	<Type II>	0.550	1.950	3.884
Taiwan	<Type I>	0.737	1.704	0.658
	<Type II>	0.695	1.820	0.737
(Group average)	<Type I>	0.715	1.612	0.834
	<Type II>	0.685	1.754	1.483
II. Moderately Outward Oriented:				
Malaysia	<Type I>	0.995	1.328	0.738
	<Type II>	1	1.354	0.763
Thailand	<Type I>	0.994	1.696	3.347
	<Type II>	0.764	1.747	5.023
(Group average)	<Type I>	0.994	1.512	2.042
	<Type II>	0.882	1.550	2.893
II. Moderately Outward Oriented:				
China	<Type I>	0.815	1.510	1.354
	<Type II>	0.236	1.785	3.096
Indonesia	<Type I>	0.878	1.778	1.780
	<Type II>	0.718	1.824	3.606
Philippine	<Type I>	0.926	1.387	0.648
	<Type II>	1	1.477	1.099
(Group average)	<Type I>	0.873	1.558	1.261
	<Type II>	0.651	1.695	2.600

Table 6. Actual export condition information

	C	R	INS
I. Strongly Outward Oriented:			
Hong Kong	0.242	1.374	0.260
Korea(Republic of)	0.196	1.815	1.020
Singapore	0.173	1.854	2.331
Taiwan	0.160	1.787	0.757
(Group average)	0.193	1.708	1.092
II. Moderately Outward Oriented:			
Malaysia	0.890	1.354	0.763
Thailand	0.497	1.742	3.396
(Group average)	0.694	1.548	2.080
II. Moderately Outward Oriented:			
China	0.130	1.654	1.608
Indonesia	0.241	1.779	2.417
Philippine	0.391	1.477	1.099
(Group average)	0.254	1.637	1.708

5.5 Different Objective

As been mentioned in section 1.3, within the growth-fluctuation framework, an export portfolio can also be constructed under a different objective other than the previous one of minimizing total export instability. "If diversification involves shifting resources into substantially less productive uses, then the cost will be large"[Massell: 1970, p629]. Therefore, while maximizing export growth may serve as the primary export objective especially for LDCs, we should examine how this objective can also contribute to the other objective of minimizing total export instability.

In order to capture the most of the world trade market, it is reasonable to use world trade growth rates as the common objective for every exporting country to expand its export sector or, in other words, to use its export resources in the most efficient way under the objective of maximizing long-term growth rate. In doing so, minimizing total export instability will be treated as the secondary objective which may also be more or less achieved automatically.

During the investigation period, the long-term average growth rates for all twenty-eight two-digit SITC product categories investigated in this study have been measured according to equation (5) and will be presented in the following Table 7.

Table 7. Average annual growth rates for manufactured products in OECD markets (1965-90)

#	description	R	#	description	R
82	Furniture	1.479	55	Cosmetics	1.366
83	Travel goods	1.462	59	Chemical pdt.	1.364
73	Transp. veh.	1.449	69	Metal mater.	1.358
85	Footwear	1.446	53	Printing mater.	1.353
84	Clothing	1.439	52	Synthetic chem.	1.348
72	Electronic pdt.	1.437	66	Non-metal pdt.	1.319
58	Plastic mater.	1.424	64	Paper materials	1.316
54	Medical pdt.	1.416	57	Explosive pdt.	1.312
89	Mfd goods	1.414	63	Wood products	1.288
86	Precision pdt.	1.404	65	Textile pdt.	1.281
62	Rubber mater.	1.404	67	Steel products	1.278
71	Machinery pdt.	1.389	56	Fertilizers	1.273
51	Chemical mater.	1.371	61	Leather pdt.	1.273
81	Utility fixt.	1.368	68	Non-ferrous	1.243

= 2-digit SITC code.
Data source: O.E.C.D. Series C Trade by Commodities.

For each sample nation, we therefore perform the simulation test similar to the previous one but now based on the newly determined product selection list presented in the above Table 7. In the end, while all the new simulation results will be presented in Table 8 and Chart 2 in the Appendix (from pages 67 to 75), the corresponding regression analyses will also be performed and their results will be presented in Table 4 under the sub-title of 'Type II', which means 'under the objective of maximizing total export growth rate'.

Interestingly, a quite consistent pattern can be observed between the regression results under either sub-title of 'Type I' or 'Type II' in Table 4, respectively. Therefore, similar conclusions stated with respect to the 'Type I' regression results in the previous section can also be satisfactorily applied here.

While also summarizing the optimal condition information obtained in this place into the previous Table 5 under the sub-title of 'Type II', we can observe that, although the return-risk trade-off ratio can vary among nations, its universal existence is sufficient to support another conventional portfolio concept of compensating higher fluctuation with higher growth rate for each sample nation.

5.6 Summary

Although only twenty-eight manufactured export divisions in each sample nation have been examined in this study, the testing results can still be shown to be quite significant in the statistical sense. Therefore, similar studies using a more complete data set including, for example, agricultural products, should only further confirm this study's findings, since more chances to further minimize total export instability and product concentration can be available in the simulation tests.

For a typical policy of product diversification, while its effect can always decrease the nation's degree of product concentration to some extent, it may not contribute to any reduction of the nation's total export instability, especially when the stage of perfect diversification of all 'product-specific' impacts is already achieved. Therefore, the conventional proposition of a significant relationship between product concentration and total export instability should only be supported before total export instability can be efficiently diversified.

Another conventional opinion favoring outward-oriented direction especially for the group of LDCs has also been supported and further enriched from this study. This is because those 'Strong-Outward-Oriented' sample nations as a group can be shown to have an absolutely superior performance over that of the other two groups of 'Moderately-Outward-Oriented' and 'Moderately-Inward-Oriented' sample nations.

While some previous studies suggest that "world market conditions appear to account for export instability in the majority of countries"[Love:1985, p250] or, "in general, the results suggest that export instability originates mainly from foreign resources"[Wong:1986, p282], some others point to internal fluctuations as a major determinant of export instability[Charette: 1985]. However, under the condition of perfect diversification of all 'product-specific' impacts, if comparing the minimum total export instability information in Table 1 between Hong Kong and every other sample nation, we may suspect that the part of international 'systematic' impacts may be far smaller than the part of national 'systematic' impacts.

While this issue deserves further research effort, it is certainly not the main interest to be carried out in this study. However, if Hong Kong's total export instability can indeed be said to reflect only international systematic impacts when others still contain the part of nation-specific systematic impacts, then we can certainly lead to and therefore enrich the Kravis(1970) conclusion that export success depends on domestic rather than external factors.

Chapter Six Conclusion

In general, "there is more than one aspect to fluctuations,..., we need to know what aspect of fluctuations will be dampened by diversification"[Katrak:1973, p556]. In Chapter Three, it has been demonstrated that, by employing the portfolio approach and its concept of risk diversification, we can focus on the part of diversifiable 'product-specific' forces causing the nation's 'excessive' export instability. This is because all 'systematic' forces can link perfectly to the 'impacts' of total export instability and therefore should be treated as a different issue for research studies. Furthermore, the link between product concentration and total export instability can also be explained theoretically while employing the portfolio approach.

Without knowing the exact compositions of both dependent and explanatory variables, it seems a reasonable approach to perform a customary statistical regression test to investigate their relationship. While measures of both total export instability and product concentration can be easily observed to have exactly identical elements in their compositions, obviously we need to examine if there exists a certain mechanical relationship between them before designing and conducting an appropriate empirical test.

It appears that only very few previous studies such as

MacBean and Nguyen(1987, CH4) have questioned this mechanical relationship between product concentration and total export instability. We also suspect that, so far, this relationship can not be mechanically constructed based on our current knowledge. We therefore believe that an indirect empirical approach is in fact more appropriate than a direct one to investigate this relationship. In Chapter Four, the indirect empirical method has been designed by allowing both product concentration and total export instability to be affected by the same policy of product diversification. After making continuous policy manipulations, we can then obtain a series of outcomes as policy impacts for a simple regression analysis.

Initially, the objective of constructing an export portfolio is to minimize total export fluctuation. However, under a two-dimensional growth-fluctuation framework, it is also possible for the export portfolio to expand under a different objective of maximizing its growth rate. Setting identical objectives for all sample nations to expand their export portfolios, the indirect empirical tests have been performed in Chapter Five.

The empirical results do suggest that, other than the unique exception of Hong Kong already enjoying extremely low 'initial' export instability and therefore having only very few new products available to further minimize its total export instability, the conventional proposition of a significant relationship between product concentration and total export instability has been strongly supported, though only conditionally from this study.

Under a two-dimensional growth-fluctuation framework, the rules of the game can be different from that in the traditional one-dimensional growth world. For example, between two export products, the one with both higher (world) growth rate and higher instability may not be a dominant product if judged in the two-dimensional sense. In this study, the conventional opinion of favoring an outward-oriented direction for LDCs is generally supported, since the empirical data for those Strongly-Outward-Oriented sample nations as a group is shown to have an absolutely dominant performance over that of the other two groups of sample nations.

However, faced with two different sets of export information whose orders of dominance in the two-dimensional sense can not be clearly identified, then obviously certain two-dimensional rules of export dominance would have to be introduced. The next immediate extension from this study is therefore to create a perfect set of two-dimensional rules of export dominance, when it is still imperfect up to this date. Only after that, issues such as the optimal structure in the export sector, the impacts of total export instability, or even international export and economic integration can be appropriately studied under the two-dimensional growth-fluctuation framework.

The Appendix Section. Tables & Charts

Variable notations in Tables 3 & 8, Charts 1 & 2:

SC: simple index of product concentration

R: long-term average export growth rate

INS: total export instability

C: Herfindahl coefficient

Table 2. Product evaluations and selections - Taiwan

(1 of 3)

S\#	2	3	4	5	6	7	8	9	10
51	1.8327	.8330	.7319	.7027	.6751	*.6642	.	.	.
52	2.0667	.8630	.7494	.7121	.6823	.6699	.6648	.6613	.6599
53	2.0352	.8609	.7480	.7108	.6812	.6692	.6642	.6607	.6592
54	2.0419	.8627	.7505	.7139	.6846	.6708	.6658	.6622	.6607
55	2.1216	.9411	.8254	.7714	.7426	.7084	.7038	.6996	.6977
56	2.0520	.8611	.7485	.7113	.6816	.6694	.6643	.6608	.6593
57	2.0186	.8627	.7498	.7124	.6827	.6703	.6651	.6616	.6601
58	1.9805	.8510	.7396	.7060	.6761	.6673	.6624	*.6592	.
59	2.0082	.8572	.7456	.7089	.6794	.6680	.6629	.6594	*.6580
61	2.0358	.8602	.7490	.7115	.6816	.6703	.6652	.6616	.6603
62	2.0108	.8650	.7548	.7174	.6871	.6737	.6688	.6653	.6640
63	A	.	.	.	.	.	.	.	.
64	2.0548	.8662	.7524	.7151	.6854	.6718	.6668	.6632	.6618
65	1.4852	.8097	*.7111	.	.	.	.	.	.
66	1.9702	.8493	.7399	.7112	.6811	.6706	.6658	.6624	.6612
67	1.9328	.8542	.7312	.7026	.6714	.6656	*.6607	.	.
68	2.0446	.8860	.7728	.7293	.7000	.6821	.6768	.6730	.6712
69	1.6962	.8495	.7405	.7109	.6816	.6724	.6681	.6654	.6644
71	1.6918	.9040	.7695	.7310	.7008	.6933	.6870	.6840	.6823
72	1.1684	.7676	.7268	.6912	*.6693	.	.	.	.
73	2.1088	.8889	.7658	.7308	.7010	.6902	.6849	.6822	.6809
81	2.2548	.8914	.7692	.7289	.6976	.6764	.6712	.6675	.6657
82	1.8944	.8651	.7498	.7185	.6880	.6714	.6665	.6635	.6623
83	1.8707	.8638	.7554	.7168	.6878	.6711	.6662	.6625	.6615
84	*0.8610	.	.	.	.	.	.	.	.
85	1.0906	*.7483	.	.	.	.	.	.	.
86	1.6104	.8027	.7124	*.6814	.	.	.	.	.
89	1.2134	.7771	.7113	.6922	.6706	.6783	.6750	.6714	.6704
X	84	85	65	86	72	51	67	58	59

A = the hypothesized 'initial' export condition.
S = 2-digit SITC code.
X = product division selected.
# = number of product divisions included in the measurement of export instability.
* = minimum instability.

S\#	11	12	13	14	15	16	17	18	19
51	.	.	.	.	.	.	.	.	.
52	.6587	.6587	*.6588	.	.	.	.	.	.
53	*.6580	.	.	.	.	.	.	.	.
54	.6595	.6595	.6596	.6602	.6612	*.6622	.	.	.
55	.6965	.6964	.6965	.6972	.6980	.6991	.7006	.7012	.7045
56	.6581	*.6581	.	.	.	.	.	.	.
57	.6589	.6589	.6590	*.6597	.	.	.	.	.
58	.	.	.	.	.	.	.	.	.
59	.	.	.	.	.	.	.	.	.
61	.6591	.6591	.6592	.6599	*.6608	.	.	.	.
62	.6628	.6628	.6629	.6636	.6645	.6656	.6670	.6688	.6712
63	.	.	.	.	.	.	.	.	.
64	.6606	.6606	.6607	.6613	.6622	.6633	.6647	.6665	*.6688
65	.	.	.	.	.	.	.	.	.
66	.6600	.6600	.6600	.6607	.6615	.6626	*.6640	.	.
67	.	.	.	.	.	.	.	.	.
68	.6700	.6700	.6701	.6708	.6717	.6728	.6742	.6755	.6778
69	.6633	.6633	.6634	.6640	.6648	.6660	.6673	.6688	.6716
71	.6811	.6811	.6812	.6818	.6828	.6838	.6852	.6849	.6854
72	.	.	.	.	.	.	.	.	.
73	.6798	.6798	.6798	.6805	.6814	.6824	.6839	.6850	.6873
81	.6644	.6644	.6645	.6652	.6661	.6669	.6683	.6699	.6719
82	.6610	.6610	.6611	.6618	.6627	.6637	.6651	.6667	.6693
83	.6603	.6603	.6604	.6611	.6620	.6631	.6645	*.6663	.
84	.	.	.	.	.	.	.	.	.
85	.	.	.	.	.	.	.	.	.
86	.	.	.	.	.	.	.	.	.
89	.6695	.6694	.6695	.6700	.6704	.6712	.6726	.6755	.6772
X	53	56	52	57	61	54	66	83	64

S\#	20	21	22	23	24	25	26	27	28
51	.	.	.	.	.	.	.	.	.
52	.	.	.	.	.	.	.	.	.
53	.	.	.	.	.	.	.	.	.
54	.	.	.	.	.	.	.	.	.
55	.7071	.7099	.7151	.7202	.7253	.7247	.7303	.7394	.7571
56	.	.	.	.	.	.	.	.	.
57	.	.	.	.	.	.	.	.	.
58	.	.	.	.	.	.	.	.	.
59	.	.	.	.	.	.	.	.	.
61	.	.	.	.	.	.	.	.	.
62	.6738	*.6766	.	.	.	.	.	.	.
63	.	.	.	.	.	.	.	.	.
64	.	.	.	.	.	.	.	.	.
65	.	.	.	.	.	.	.	.	.
66	.	.	.	.	.	.	.	.	.
67	.	.	.	.	.	.	.	.	.
68	.6803	.6830	.6880	.6929	.6978	.7013	*.7084	.	.
69	.6740	.6770	*.6820	.	.	.	.	.	.
71	.6875	.6875	.6918	.6952	.6981	*.7000	.	.	.
72	.	.	.	.	.	.	.	.	.
73	.6897	.6925	.6974	.7028	.7071	.7106	.7178	*.7262	.
81	.6744	.6774	.6821	*.6868	.	.	.	.	.
82	*.6718	.	.	.	.	.	.	.	.
83	.	.	.	.	.	.	.	.	.
84	.	.	.	.	.	.	.	.	.
85	.	.	.	.	.	.	.	.	.
86	.	.	.	.	.	.	.	.	.
89	.6795	.6802	.6846	.6884	*.6925	.	.	.	.
X	82	62	69	81	89	71	68	73	55

Table 3.CH & Chart 1.CH Simulation results -- Tape I test

(China) (1 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.1949	1.3186	4396.8	15	0.1741	0.8149	1.5096	1.3544
2	0.5039	0.3646	1.4748	2.7783	16	0.1741	0.8149	1.5105	1.3553
3	0.3700	0.4449	1.4534	1.7748	17	0.1722	0.8196	1.5146	1.3570
4	0.3144	0.4891	1.4464	1.6170	18	0.1655	0.8369	1.5183	1.3597
5	0.2406	0.6724	1.4150	1.5447	19	0.1655	0.8370	1.5185	1.3628
6	0.2175	0.7124	1.4103	1.4830	20	0.1655	0.8371	1.5199	1.3678
7	0.2120	0.7218	1.4653	1.4322	21	0.1624	0.8453	1.5212	1.3730
8	0.1838	0.7927	1.4720	1.4068	22	0.1623	0.8455	1.5238	1.3781
9	0.1829	0.7947	1.4744	1.3875	23	0.1605	0.8503	1.5261	1.3842
10	0.1920	0.7967	1.4999	1.3733	24	0.1587	0.8552	1.5361	1.3923
11	0.1795	0.8023	1.5077	1.3596	25	0.1570	0.8598	1.5432	1.4047
12	0.1772	0.8077	1.5078	1.3564	26	0.1559	0.8629	1.5778	1.4450
13	0.1743	0.8144	1.5084	1.3550	27	0.1489	0.8849	1.6378	1.4531
14	0.1743	0.8144	1.5085	1.3545	28	0.1298	1	1.6537	1.6076

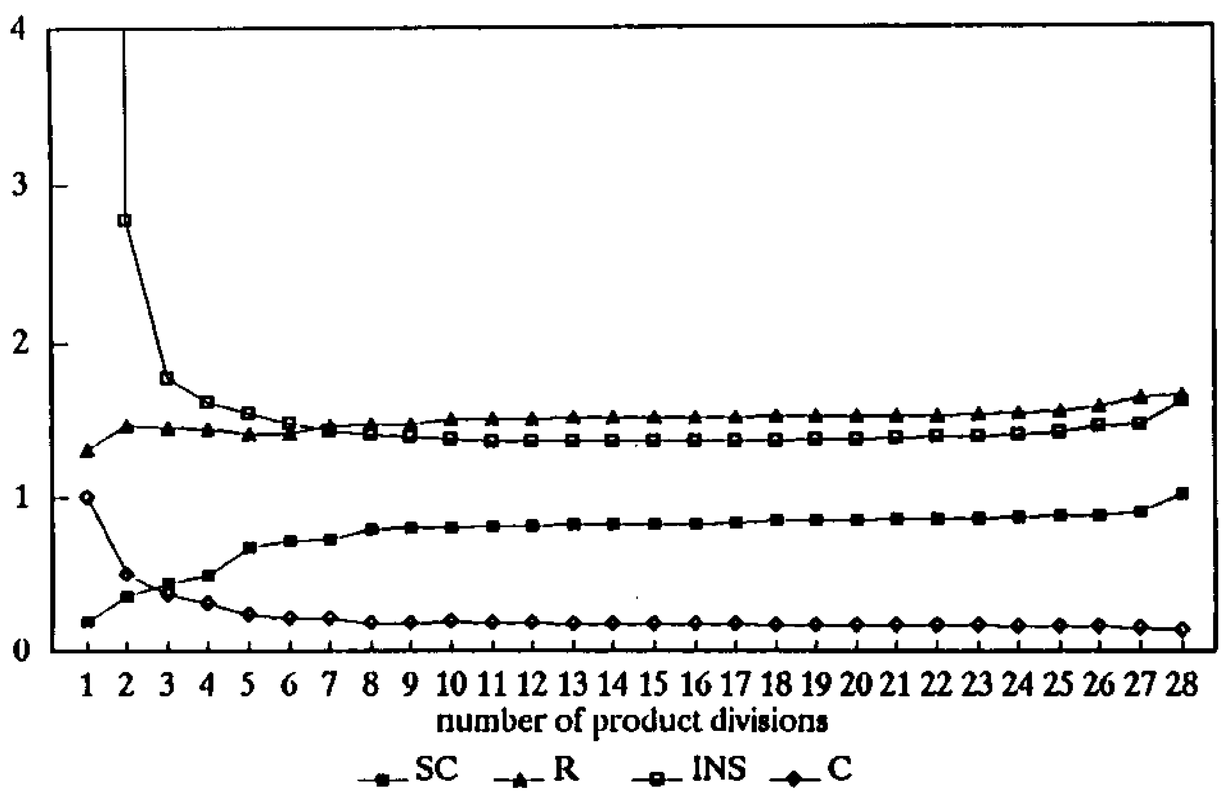


Table 3.HK & Chart 1.HK Simulation results -- Tape I test

(Hong Kong) (2 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.4111	1.3722	0.2497	15	0.4908	0.6648	1.3586	0.1889
2	0.5481	0.6276	1.3612	0.1947	16	0.4860	0.6681	1.3583	0.1895
3	0.4979	0.6600	1.3569	0.1904	17	0.4859	0.6682	1.3584	0.1904
4	0.4952	0.6618	1.3569	0.1890	18	0.4844	0.6692	1.3584	0.1913
5	0.4950	0.6620	1.3572	0.1885	19	0.4747	0.6761	1.3578	0.1929
6	0.4948	0.6621	1.3573	0.1883	20	0.4556	0.6905	1.3558	0.1961
7	0.4946	0.6623	1.3574	0.1882	21	0.4124	0.7281	1.3554	0.1998
8	0.4939	0.6628	1.3574	0.1882	22	0.4035	0.7362	1.3546	0.2037
9	0.4939	0.6628	1.3574	0.1882	23	0.3863	0.7529	1.3555	0.2078
10	0.4939	0.6628	1.3574	0.1882	24	0.3566	0.7854	1.3535	0.2141
11	0.4936	0.6629	1.3576	0.1882	25	0.2822	0.9171	1.3385	0.2209
12	0.4928	0.6634	1.3580	0.1883	26	0.2806	0.9197	1.3528	0.2296
13	0.4918	0.6642	1.3580	0.1884	27	0.2474	0.9896	1.3643	0.2390
14	0.4914	0.6644	1.3581	0.1886	28	0.2423	1	1.3739	0.2604

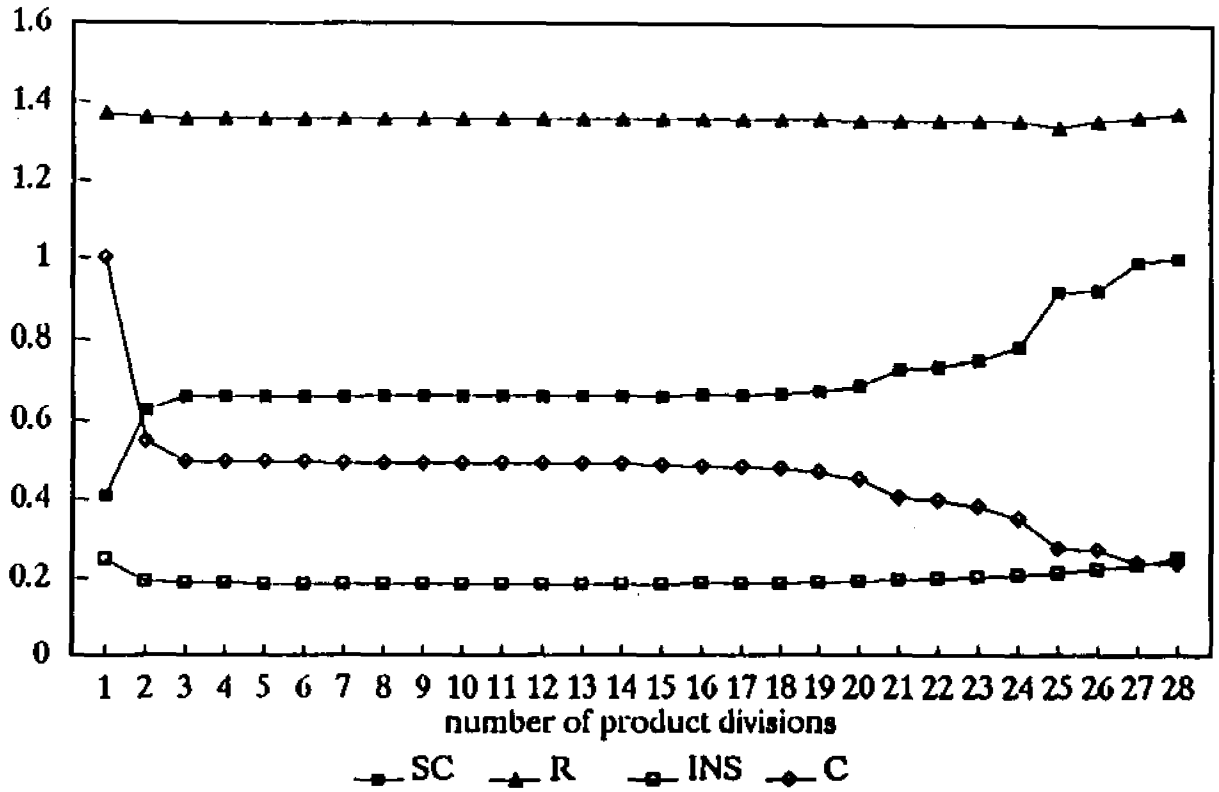


Table 3.ID & Chart 1.ID   Simulation results -- Tape I test

(Indonesia)   (3 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.3627	1.2026	3.1744	15	0.3259	0.8159	1.7767	1.7818
2	0.8266	0.4012	1.3757	2.6775	16	0.3257	0.8162	1.7770	1.7810
3	0.4554	0.6832	1.4691	2.3748	17	0.3247	0.8175	1.7781	1.7804
4	0.4501	0.6873	1.6619	2.0940	18	0.3242	0.8181	1.7783	1.7798
5	0.4217	0.7110	1.6920	1.9964	19	0.3239	0.8184	1.7788	1.7795
6	0.4164	0.7156	1.7853	1.9470	20	0.3218	0.8211	1.7810	1.7795
7	0.4134	0.7181	1.7884	1.8824	21	0.3216	0.8213	1.7901	1.7807
8	0.4119	0.7194	1.7901	1.8497	22	0.3210	0.8222	1.7901	1.7824
9	0.3749	0.7565	1.7820	1.8216	23	0.3184	0.8255	1.7896	1.7854
10	0.3729	0.7586	1.7846	1.8086	24	0.3180	0.8261	1.7899	1.7907
11	0.3677	0.7693	1.7845	1.7960	25	0.3178	0.8263	1.8062	1.8018
12	0.3674	0.7642	1.7849	1.7906	26	0.3158	0.8289	1.8094	1.8326
13	0.3284	0.8128	1.7762	1.7855	27	0.3030	0.8469	1.8064	1.9975
14	0.3262	0.8156	1.7767	1.7832	28	0.2408	1	1.7792	2.4173

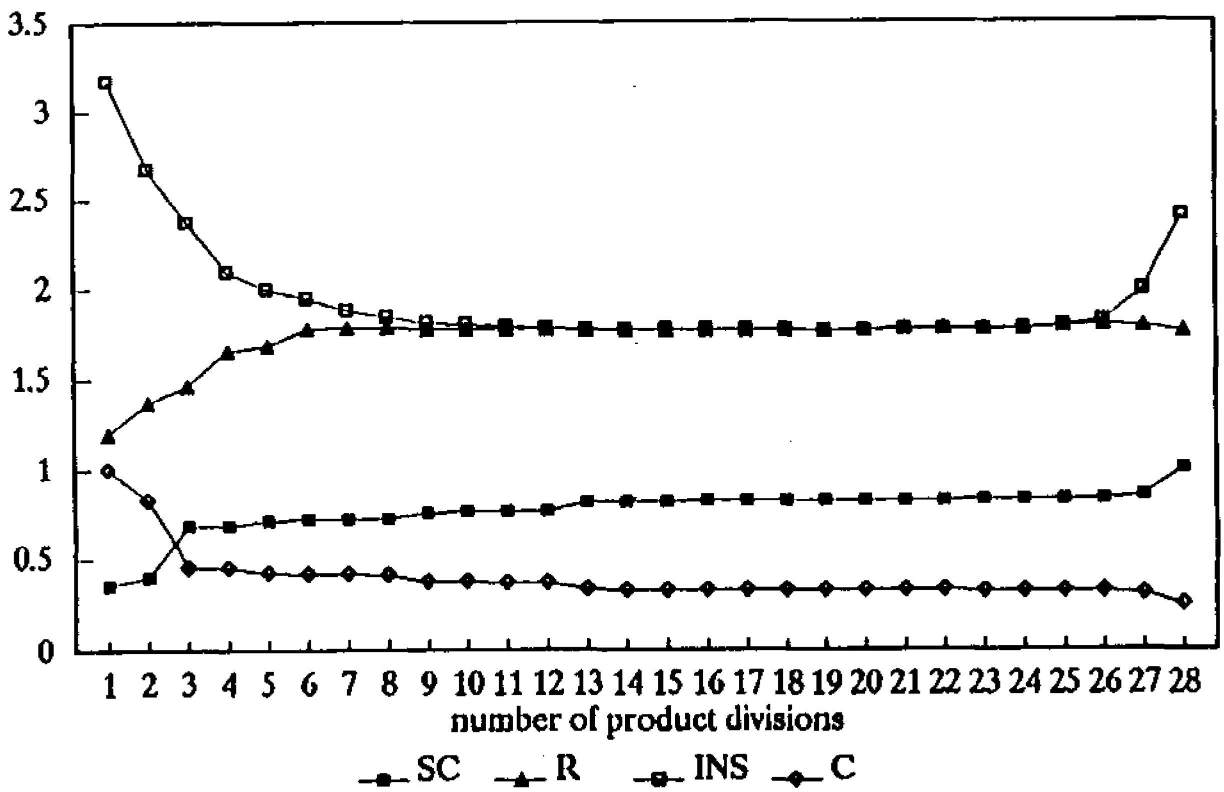


Table 3.KO & Chart 1.KO   Simulation results -- Tape I test

(Korea)   (4 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.2730	1.1100	3.2923	15	0.2227	0.9365	1.7105	0.8110
2	0.5049	0.4968	1.6720	1.0181	16	0.2212	0.9397	1.7143	0.8118
3	0.4036	0.5663	1.7173	0.9121	17	0.2210	0.9400	1.7150	0.8142
4	0.3270	0.6435	1.7436	0.8627	18	0.2209	0.9402	1.7152	0.8165
5	0.2474	0.8855	1.7076	0.8405	19	0.2209	0.9403	1.7184	0.8196
6	0.2470	0.8862	1.7121	0.8262	20	0.2164	0.9503	1.7339	0.8255
7	0.2443	0.8911	1.7147	0.8204	21	0.2129	0.9582	1.7370	0.8318
8	0.2274	0.9266	1.7096	0.8162	22	0.2127	0.9586	1.7385	0.8430
9	0.2274	0.9266	1.7099	0.8142	23	0.2126	0.9589	1.7458	0.8544
10	0.2262	0.9290	1.7099	0.8127	24	0.2081	0.9694	1.7516	0.8685
11	0.2230	0.9357	1.7091	0.8116	25	0.2052	0.9764	1.7512	0.8886
12	0.2230	0.9359	1.7097	0.8110	26	0.2012	0.9862	1.7706	0.9255
13	0.2229	0.9360	1.7097	0.8106	27	0.2006	0.9878	1.7804	0.9726
14	0.2229	0.9360	1.7104	0.8104	28	0.1959	1	1.8148	1.0203

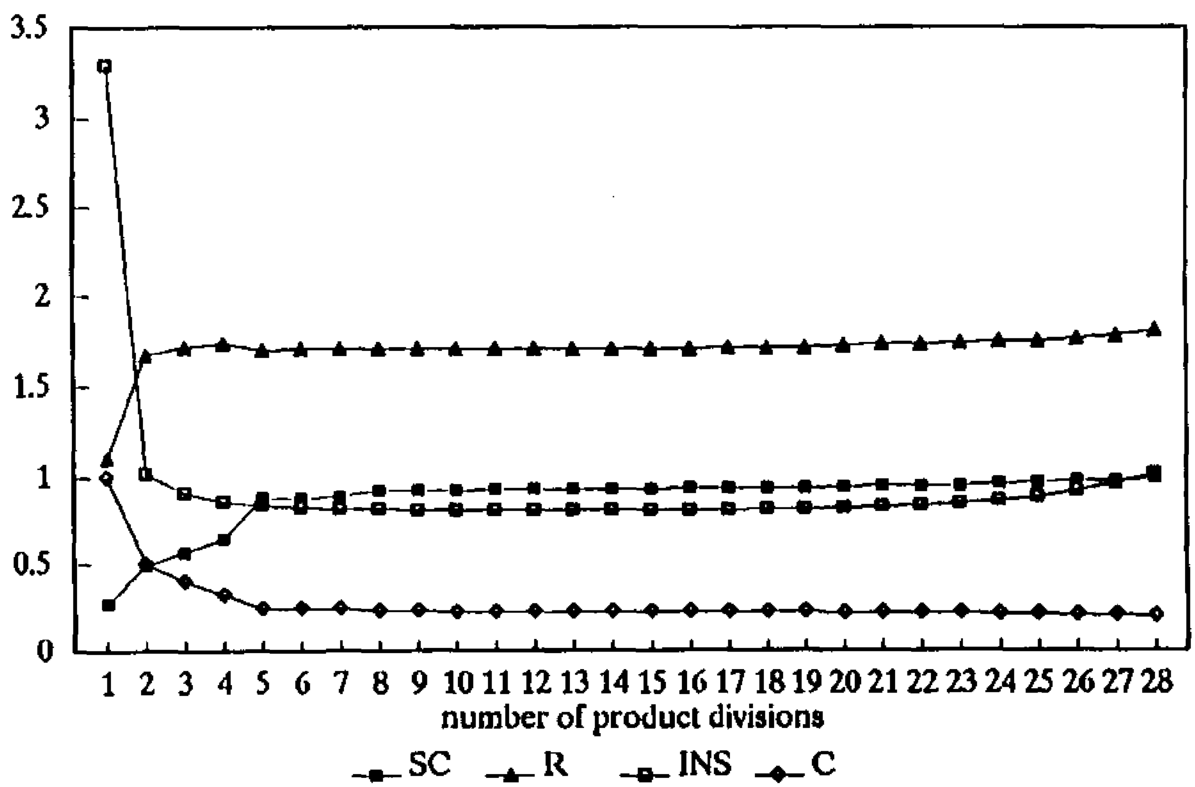


Table 3.MA & Chart 1.MA Simulation results -- Tape I test

(Malaysia) (5 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.9465	0.9880	1.2275	15	0.9096	0.9928	1.3263	0.7385
2	0.9998	0.9466	1.2907	0.8469	16	0.9049	0.9953	1.3275	0.7385
3	0.9742	0.9591	1.2950	0.7990	17	0.9049	0.9953	1.3275	0.7385
4	0.9428	0.9750	1.3136	0.7682	18	0.9037	0.9960	1.3277	0.7386
5	0.9218	0.9861	1.3164	0.7588	19	0.9035	0.9961	1.3287	0.7388
6	0.9153	0.9897	1.3184	0.7521	20	0.9034	0.9962	1.3288	0.7390
7	0.9151	0.9898	1.3187	0.7470	21	0.9034	0.9962	1.3290	0.7393
8	0.9140	0.9904	1.3189	0.7436	22	0.9012	0.9974	1.3289	0.7397
9	0.9116	0.9917	1.3221	0.7401	23	0.9001	0.9980	1.3301	0.7411
10	0.9113	0.9918	1.3253	0.7395	24	0.9000	0.9980	1.3302	0.7425
11	0.9102	0.9924	1.3254	0.7389	25	0.8976	0.9994	1.3303	0.7440
12	0.9102	0.9924	1.3258	0.7387	26	0.8976	0.9994	1.3322	0.7493
13	0.9101	0.9925	1.3259	0.7386	27	0.8966	0.9999	1.3443	0.7561
14	0.9101	0.9925	1.3259	0.7386	28	0.8965	1	1.3544	0.7632

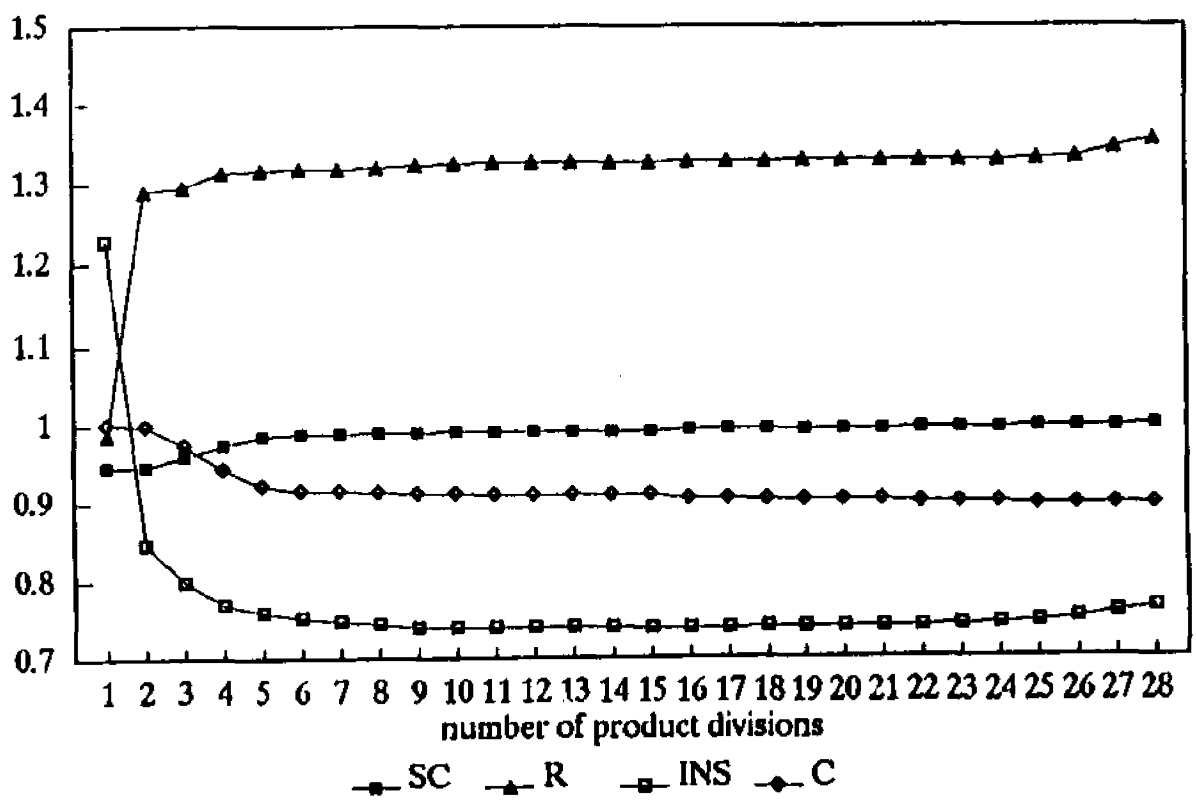


Table 3.PH & Chart 1.PH   Simulation results -- Tape I test

(Philippine)   (6 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.4430	1.1632	2.2185	15	0.4525	0.9260	1.3877	0.6524
2	0.5000	0.8800	1.3611	0.9975	16	0.4518	0.9268	1.3890	0.6558
3	0.4997	0.8804	1.3646	0.8092	17	0.4506	0.9280	1.4016	0.6598
4	0.4807	0.8979	1.3828	0.7417	18	0.4505	0.9281	1.4030	0.6632
5	0.4803	0.8983	1.3856	0.6992	19	0.4505	0.9281	1.4034	0.6678
6	0.4596	0.9188	1.3852	0.6692	20	0.4501	0.9285	1.4058	0.6895
7	0.4596	0.9188	1.3868	0.6537	21	0.4500	0.9286	1.4063	0.7117
8	0.4595	0.9189	1.3868	0.6515	22	0.4440	0.9349	1.4152	0.7452
9	0.4536	0.9249	1.3860	0.6498	23	0.4431	0.9359	1.4190	0.7706
10	0.4530	0.9255	1.3864	0.6489	24	0.4414	0.9377	1.4259	0.7872
11	0.4529	0.9256	1.3870	0.6483	25	0.3949	0.9956	1.4260	0.8252
12	0.4528	0.9257	1.3870	0.6479	26	0.3937	0.9971	1.4271	0.8639
13	0.4527	0.9258	1.3870	0.6484	27	0.3922	0.9990	1.4309	0.9130
14	0.4527	0.9258	1.3876	0.6503	28	0.3914	1	1.4771	1.0989

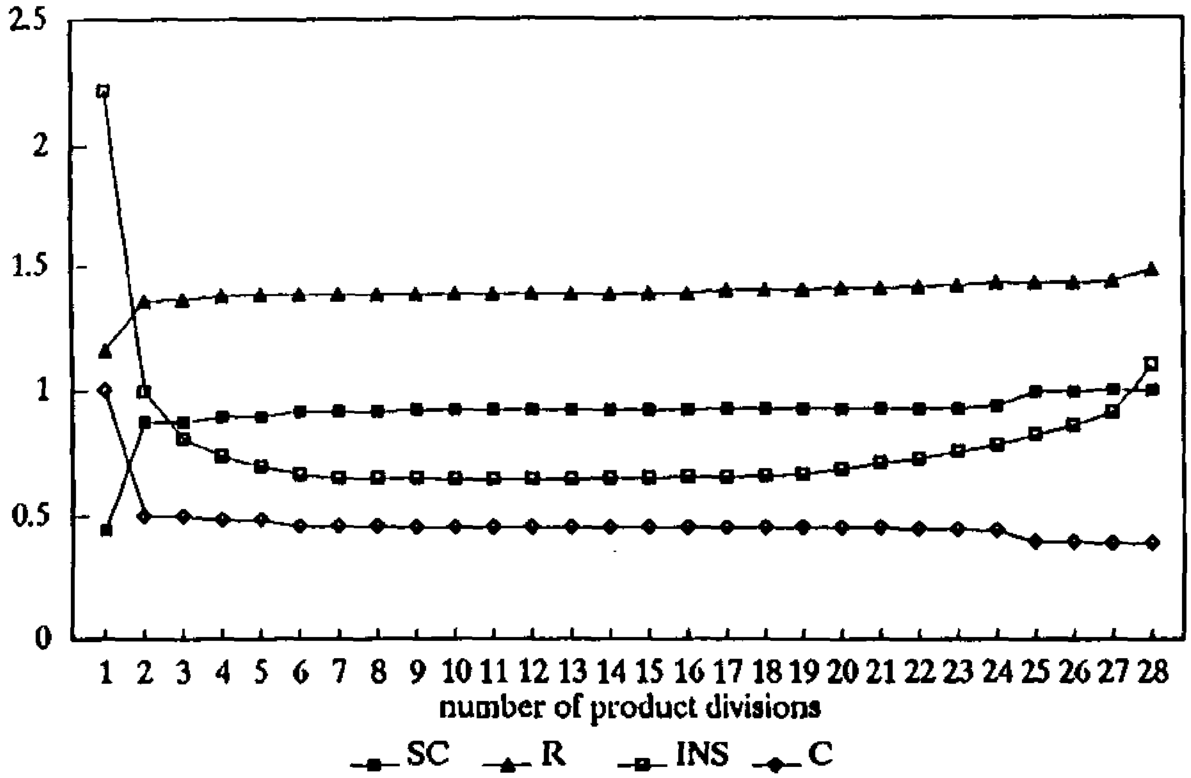


Table 3.SI & Chart 1.SI   Simulation results -- Tape I test

(Singapore)   (7 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.3144	1.5801	2.8454	15	0.4362	0.5265	1.6778	1.6833
2	0.9378	0.3248	1.6978	2.1698	16	0.4360	0.5266	1.6779	1.6828
3	0.5436	0.4697	1.6440	1.8569	17	0.4357	0.5268	1.6778	1.6823
4	0.5419	0.4705	1.6462	1.8075	18	0.4350	0.5272	1.6780	1.6848
5	0.5410	0.4709	1.6470	1.7688	19	0.4339	0.5279	1.6837	1.6878
6	0.4839	0.4996	1.6420	1.7508	20	0.4337	0.5280	1.6883	1.6984
7	0.4684	0.5079	1.6436	1.7355	21	0.4259	0.5329	1.6937	1.7092
8	0.4646	0.5100	1.6451	1.7214	22	0.4140	0.5406	1.7016	1.7219
9	0.4631	0.5108	1.6772	1.7045	23	0.3070	0.6695	1.6717	1.7884
10	0.4528	0.5167	1.6763	1.6916	24	0.2456	0.7825	1.6524	1.9220
11	0.4525	0.5168	1.6762	1.6884	25	0.2432	0.7864	1.6625	1.9816
12	0.4520	0.5172	1.6763	1.6860	26	0.2157	0.8444	1.6572	2.0035
13	0.4452	0.5211	1.6773	1.6848	27	0.1792	0.9800	1.7940	2.1686
14	0.4440	0.5218	1.6773	1.6838	28	0.1726	1	1.8540	2.3312

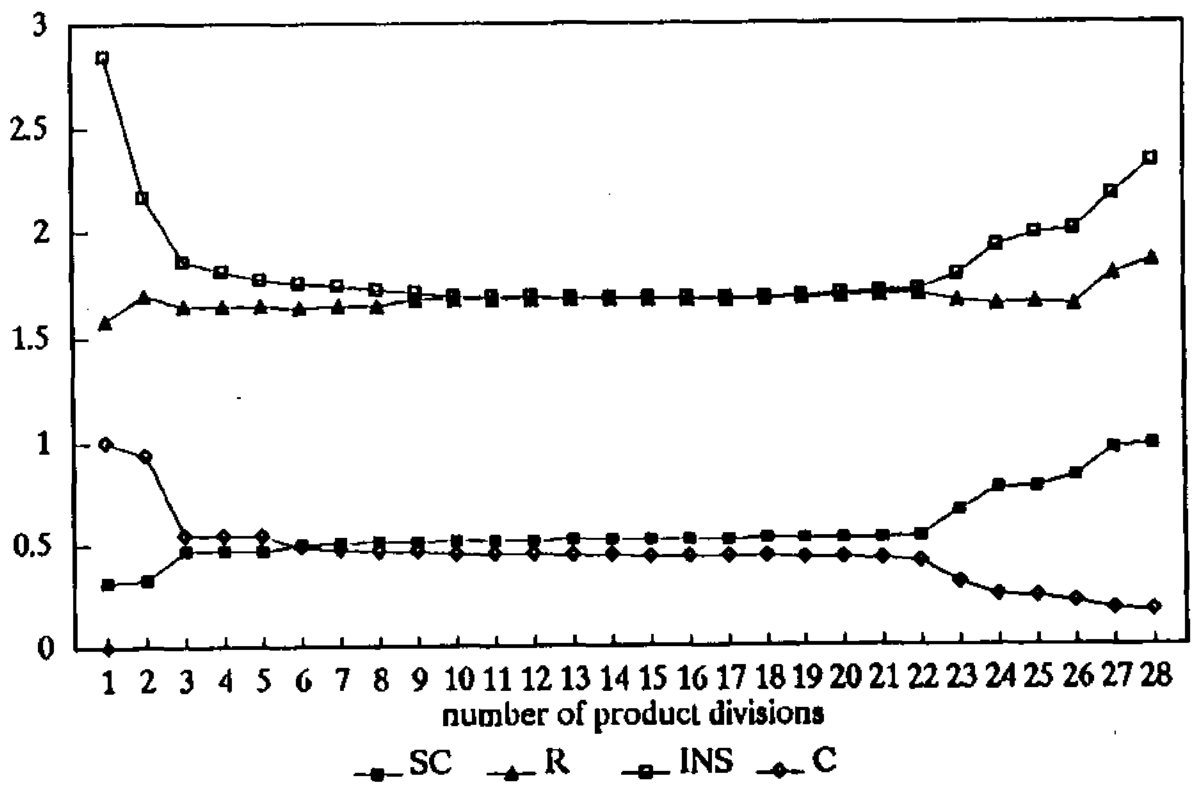


Table 3.TA & Chart 1.TA   Simulation results -- Tape I test

(Taiwan)   (8 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.2825	1.3593	2.0502	15	0.2566	0.7404	1.7051	0.6608
2	0.5198	0.4712	1.5587	0.8610	16	0.2563	0.7408	1.7052	0.6622
3	0.4738	0.4947	1.6153	0.7483	17	0.2446	0.7593	1.7079	0.6640
4	0.3369	0.6337	1.6046	0.7111	18	0.2435	0.7610	1.7141	0.6663
5	0.3344	0.6360	1.6214	0.6814	19	0.2427	0.7622	1.7150	0.6688
6	0.2818	0.7048	1.6990	0.6693	20	0.2364	0.7726	1.7253	0.6718
7	0.2644	0.7293	1.6957	0.6642	21	0.2356	0.7739	1.7277	0.6766
8	0.2631	0.7310	1.7007	0.6607	22	0.2269	0.7893	1.7423	0.6820
9	0.2590	0.7369	1.7033	0.6592	23	0.2268	0.7894	1.7432	0.6868
10	0.2589	0.7371	1.7037	0.6580	24	0.1904	0.8950	1.7586	0.6925
11	0.2588	0.7373	1.7043	0.6580	25	0.1900	0.8959	1.7966	0.7000
12	0.2587	0.7373	1.7043	0.6581	26	0.1841	0.9108	1.7948	0.7084
13	0.2587	0.7374	1.7043	0.6588	27	0.1829	0.9139	1.8019	0.7262
14	0.2582	0.7381	1.7043	0.6597	28	0.1602	1	1.7873	0.7571

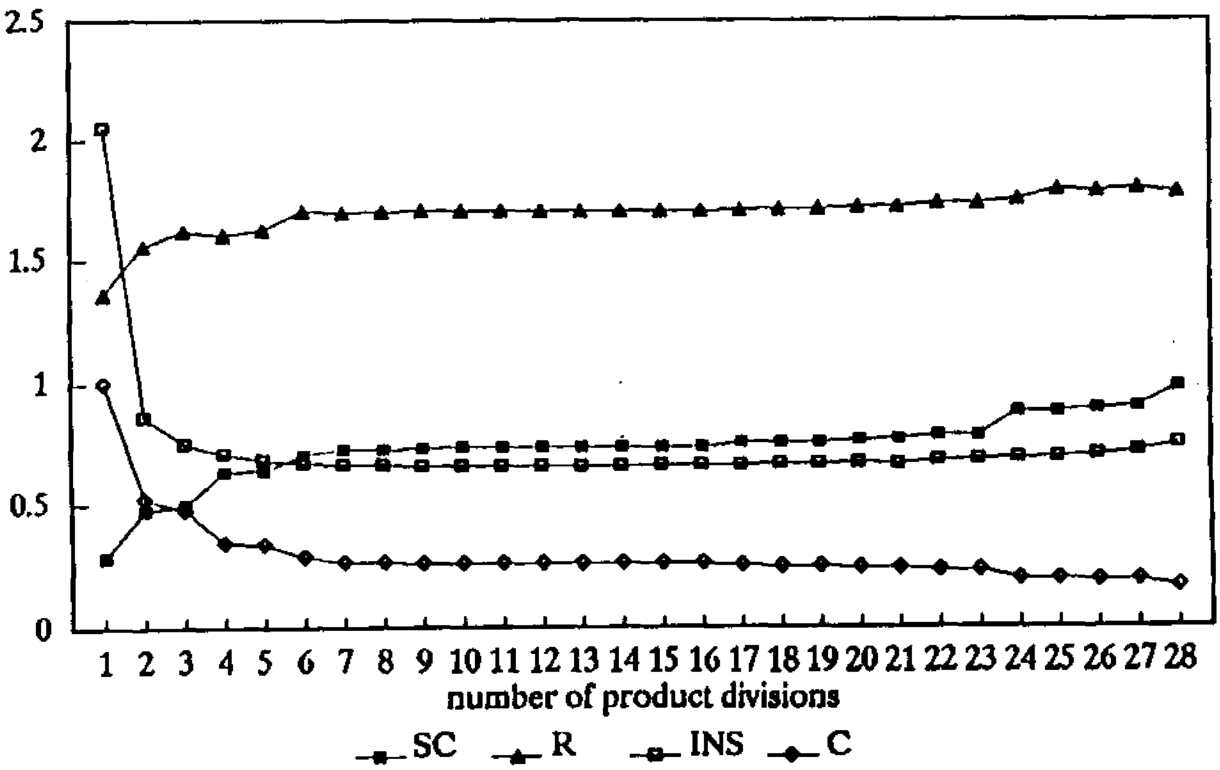


Table 3.TH & Chart 1.TH Simulation results -- Tape I test

(Thailand) (9 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.6908	1.1517	6.0121	15	0.5049	0.9919	1.6958	3.3612
2	0.7683	0.7975	1.4354	4.8226	16	0.5046	0.9922	1.6960	3.3540
3	0.7174	0.8260	1.4885	4.2658	17	0.5041	0.9926	1.6960	3.3513
4	0.6213	0.8914	1.4871	3.8416	18	0.5036	0.9932	1.6960	3.3491
5	0.5581	0.9430	1.5898	3.7226	19	0.5034	0.9933	1.6960	3.3484
6	0.5507	0.9494	1.6443	3.5792	20	0.5033	0.9934	1.6960	3.3477
7	0.5333	0.9650	1.6458	3.5060	21	0.5031	0.9937	1.6964	3.3474
8	0.5272	0.9706	1.6450	3.4585	22	0.5029	0.9938	1.6967	3.3476
9	0.5213	0.9761	1.6448	3.4244	23	0.5026	0.9942	1.6988	3.3487
10	0.5193	0.9780	1.6465	3.4077	24	0.5024	0.9943	1.7026	3.3528
11	0.5161	0.9810	1.6476	3.3972	25	0.5017	0.9951	1.7052	3.3591
12	0.5159	0.9812	1.6477	3.3886	26	0.5013	0.9955	1.7107	3.3669
13	0.5134	0.9836	1.6519	3.3800	27	0.4969	0.9999	1.7320	3.3810
14	0.5092	0.9877	1.6922	3.3691	28	0.4968	1	1.7421	3.3959

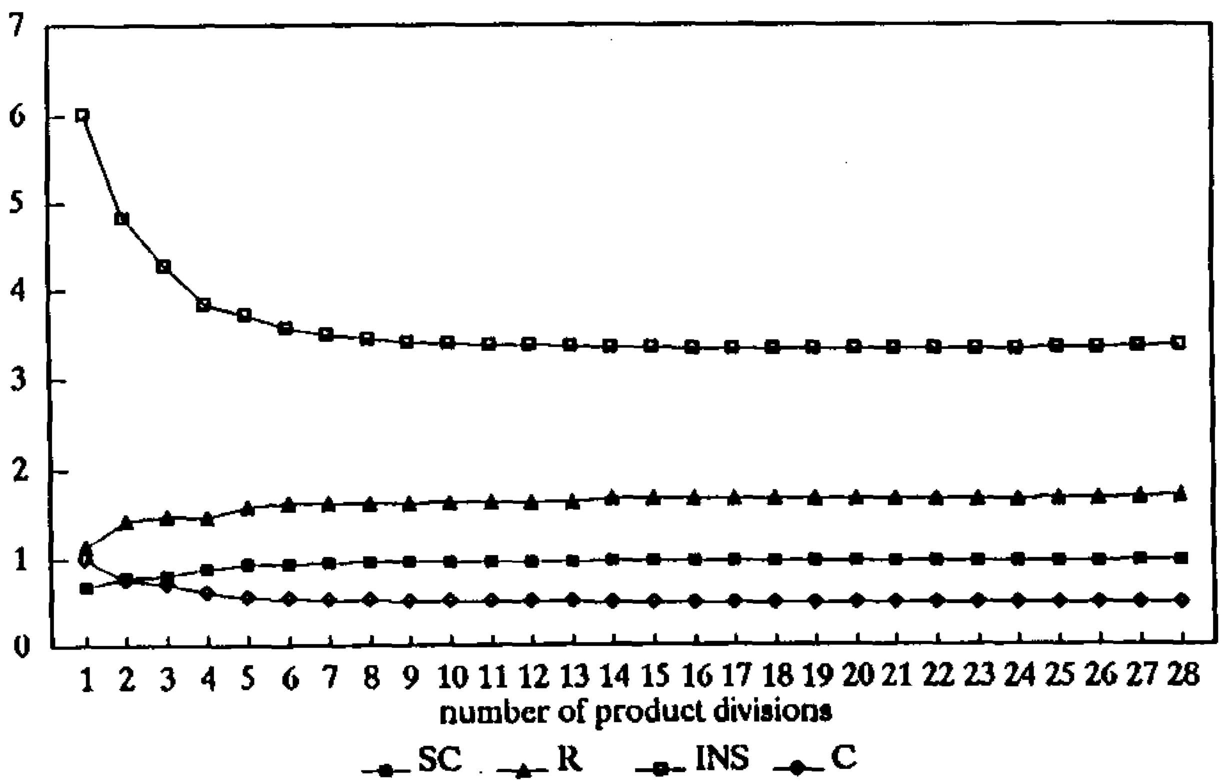


Table 8.CH & Chart 2.CH Simulation results -- Tape II test

(China) (1 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.1949	1.3186	4396.8	15	0.2971	0.4378	1.7532	2.4581
2	0.9544	0.1996	1.3778	9.1879	16	0.2564	0.4778	1.7397	2.3391
3	0.9357	0.2016	1.5097	5.7410	17	0.2086	0.5581	1.7158	1.8760
4	0.9340	0.2018	1.5207	6.4413	18	0.2051	0.5630	1.7197	1.8802
5	0.8544	0.2112	1.6012	3.7795	19	0.2013	0.5684	1.7186	1.8780
6	0.7099	0.2332	1.7486	3.2486	20	0.2013	0.5684	1.7192	1.8882
7	0.6911	0.2363	1.7844	3.0949	21	0.1904	0.5858	1.7172	1.8423
8	0.6910	0.2364	1.7850	3.0960	22	0.1862	0.5925	1.7161	1.8395
9	0.6640	0.2412	1.7841	3.1438	23	0.1850	0.5946	1.7163	1.8078
10	0.4086	0.3563	1.7717	2.8908	24	0.1802	0.6028	1.7153	1.8096
11	0.3965	0.3618	1.7730	2.7692	25	0.1580	0.7725	1.6912	1.7747
12	0.3962	0.3619	1.7731	2.7751	26	0.1580	0.7725	1.6833	1.7746
13	0.3865	0.3666	1.7756	2.7646	27	0.1442	0.8167	1.6833	1.6935
14	0.2977	0.4374	1.7529	2.4678	28	0.1298	1	1.6537	1.6076

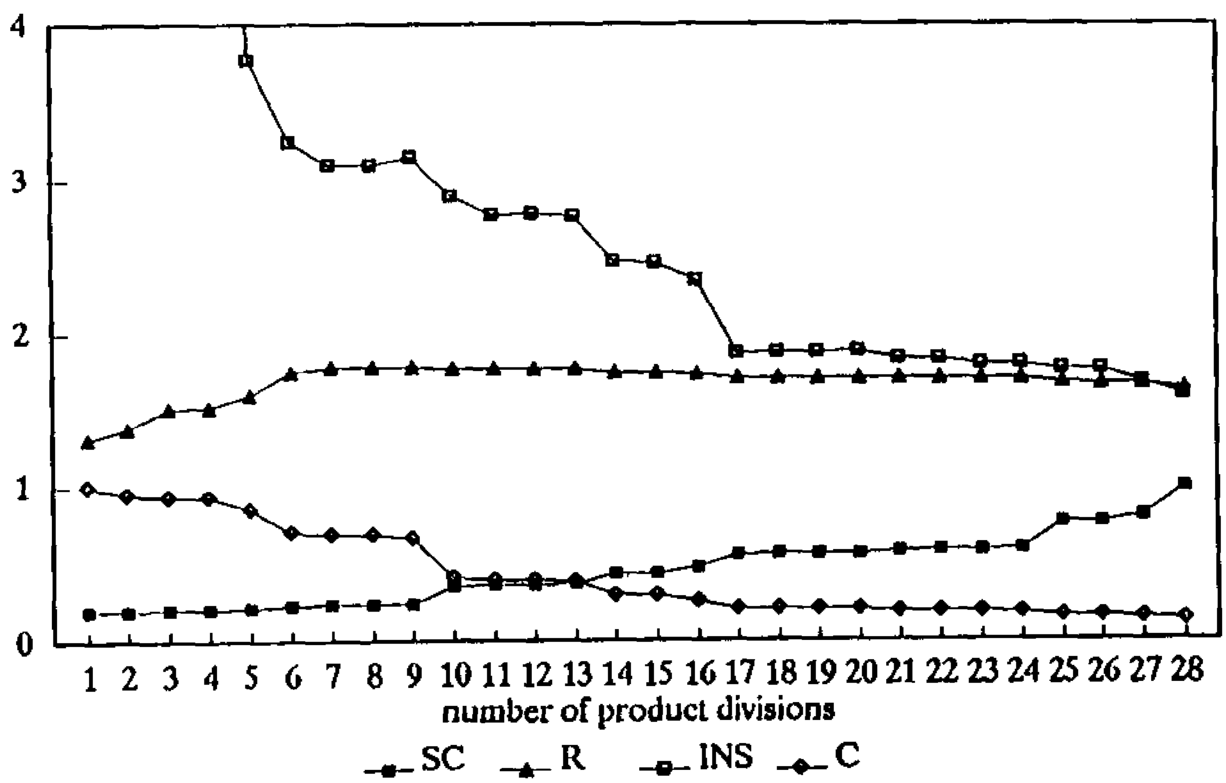


Table 8.HK & Chart 2.HK   Simulation results -- Tape II test

(Hong Kong)   (2 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.4111	1.3722	0.2497	15	0.3431	0.8068	1.3903	0.2456
2	0.9622	0.4192	1.3707	0.2528	16	0.3429	0.8070	1.3904	0.2458
3	0.8336	0.4517	1.3664	0.2498	17	0.3296	0.8237	1.3904	0.2494
4	0.8092	0.4586	1.3655	0.2508	18	0.3294	0.8238	1.3904	0.2493
5	0.7101	0.4910	1.3595	0.2388	19	0.3294	0.8238	1.3904	0.2493
6	0.5597	0.5609	1.3776	0.2284	20	0.3032	0.8615	1.3888	0.2515
7	0.5595	0.5610	1.3780	0.2279	21	0.3029	0.8619	1.3891	0.2516
8	0.5592	0.5612	1.3781	0.2279	22	0.3025	0.8624	1.3891	0.2515
9	0.3687	0.7777	1.3680	0.2086	23	0.3002	0.8657	1.3888	0.2518
10	0.3592	0.7881	1.3797	0.2332	24	0.2436	0.9973	1.3738	0.2590
11	0.3591	0.7882	1.3797	0.2340	25	0.2436	0.9975	1.3739	0.2590
12	0.3568	0.7908	1.3920	0.2419	26	0.2432	0.9982	1.3740	0.2590
13	0.3563	0.7913	1.3923	0.2418	27	0.2432	0.9982	1.3740	0.2592
14	0.3440	0.8057	1.3903	0.2446	28	0.2423	1	1.3739	0.2604

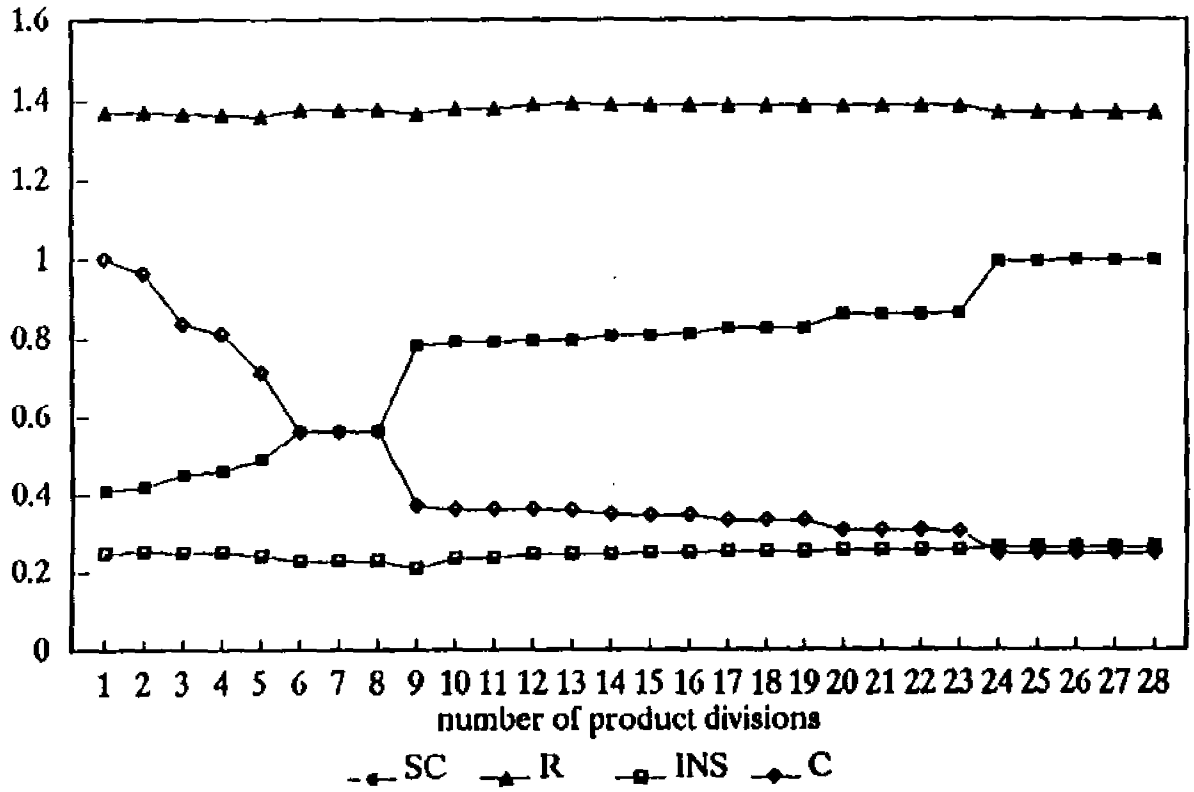


Table 8.ID & Chart 2.ID Simulation results -- Tape II test

(Indonesia) (3 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.3627	1.2026	3.1744	15	0.3900	0.6389	1.7253	4.2419
2	0.9984	0.3630	1.4887	3.9480	16	0.3893	0.6395	1.7258	4.2068
3	0.9969	0.3632	1.4952	3.9578	17	0.3861	0.6421	1.7298	4.2001
4	0.9072	0.3812	1.4968	9.8355	18	0.3822	0.6454	1.7293	4.1823
5	0.9058	0.3815	1.6325	9.7651	19	0.3448	0.6825	1.7206	4.0175
6	0.8870	0.3856	1.7820	6.5703	20	0.3427	0.6846	1.7249	3.9608
7	0.8754	0.3881	1.7878	6.1433	21	0.3421	0.6852	1.7254	3.9586
8	0.8716	0.3890	1.7880	6.1311	22	0.3418	0.6855	1.7253	3.9503
9	0.5286	0.5421	1.7347	6.1360	23	0.3373	0.6901	1.8080	3.7278
10	0.4652	0.5806	1.7311	4.8170	24	0.3164	0.7138	1.8186	3.6585
11	0.4631	0.5819	1.7332	4.7390	25	0.3141	0.7163	1.8221	3.6138
12	0.4548	0.5872	1.7336	4.6933	26	0.3139	0.7166	1.8235	3.6039
13	0.4504	0.5901	1.7348	4.7022	27	0.3127	0.7179	1.8238	3.6064
14	0.3904	0.6386	1.7247	4.2483	28	0.2408	1	1.7792	2.4173

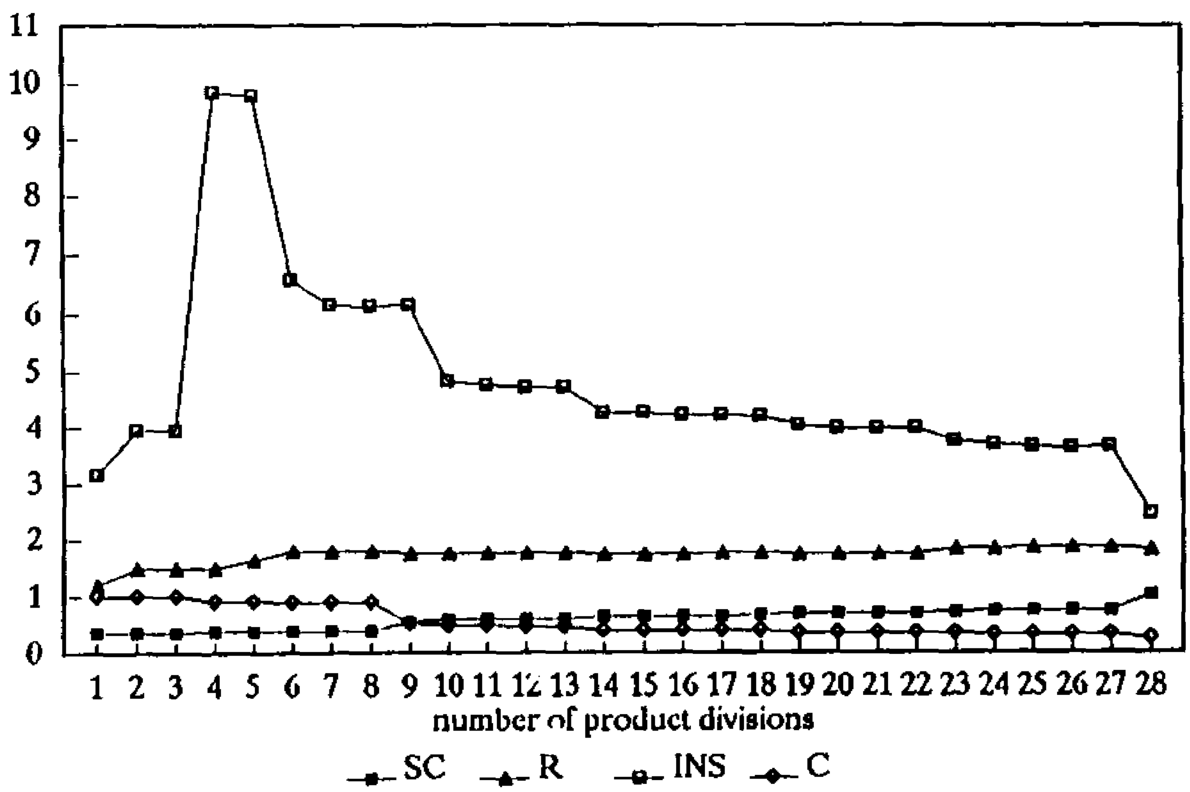


Table 8.KO & Chart 2.KO   Simulation results -- Tape II test

(Korea)   (4 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.2730	1.1100	3.2923	15	0.2940	0.6793	1.8502	1.0608
2	0.9972	0.2734	1.2968	2.7617	16	0.2936	0.6797	1.8502	1.0609
3	0.9949	0.2737	1.5034	1.9188	17	0.2880	0.6865	1.8487	1.0575
4	0.9832	0.2753	1.6249	5.7892	18	0.2796	0.6970	1.8521	1.0658
5	0.6673	0.3449	1.7176	2.0848	19	0.2795	0.6972	1.8524	1.0650
6	0.4003	0.5687	1.7539	1.0941	20	0.2794	0.6972	1.8528	1.0671
7	0.3842	0.5808	1.8175	1.1454	21	0.2734	0.7051	1.8541	1.0698
8	0.3841	0.5809	1.8204	1.1466	22	0.2681	0.7121	1.8530	1.0908
9	0.3810	0.5833	1.8201	1.1443	23	0.2681	0.7121	1.8530	1.0905
10	0.3108	0.6604	1.8264	1.0430	24	0.2136	0.9541	1.8112	1.0211
11	0.3078	0.6637	1.8289	1.0400	25	0.2094	0.9641	1.8198	1.0206
12	0.3071	0.6644	1.8318	1.0290	26	0.2093	0.9642	1.8202	1.0185
13	0.2984	0.6742	1.8493	1.0585	27	0.2092	0.9645	1.8203	1.0208
14	0.2942	0.6791	1.8501	1.0588	28	0.1959	1	1.8148	1.0203

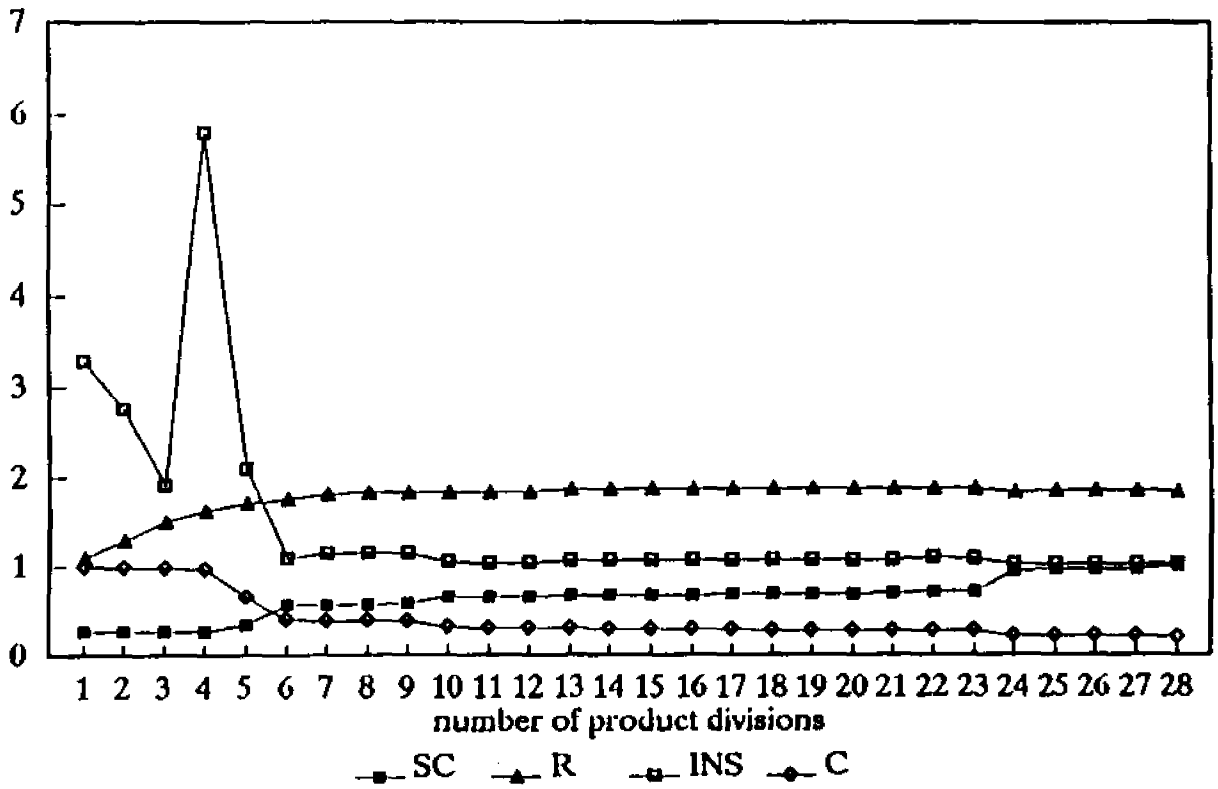


Table 8.MA & Chart 2.MA   Simulation results -- Tape II test

(Malaysia)   (5 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.9465	0.9880	1.2275	15	0.9540	0.9692	1.3455	0.8242
2	1	0.9465	1.0193	1.2269	16	0.9516	0.9704	1.3454	0.8247
3	0.9999	0.9466	1.0306	1.2285	17	0.9303	0.9816	1.3473	0.8187
4	0.9986	0.9472	1.0243	1.1999	18	0.9301	0.9817	1.3482	0.8177
5	0.9986	0.9472	1.0268	1.2008	19	0.9288	0.9823	1.3484	0.8178
6	0.9661	0.9631	1.1459	1.0386	20	0.9283	0.9826	1.3487	0.8179
7	0.9659	0.9632	1.3124	0.8161	21	0.9272	0.9832	1.3498	0.8187
8	0.9631	0.9646	1.3125	0.8177	22	0.9271	0.9832	1.3501	0.8185
9	0.9631	0.9646	1.3125	0.8177	23	0.9271	0.9832	1.3501	0.8184
10	0.9621	0.9651	1.3269	0.8273	24	0.9042	0.9957	1.3526	0.7805
11	0.9618	0.9653	1.3301	0.8297	25	0.8979	0.9992	1.3540	0.7715
12	0.9568	0.9678	1.3312	0.8290	26	0.8977	0.9993	1.3542	0.7641
13	0.9566	0.9679	1.3426	0.8299	27	0.8966	0.9999	1.3543	0.7631
14	0.9540	0.9692	1.3454	0.8240	28	0.8965	1	1.3544	0.7632

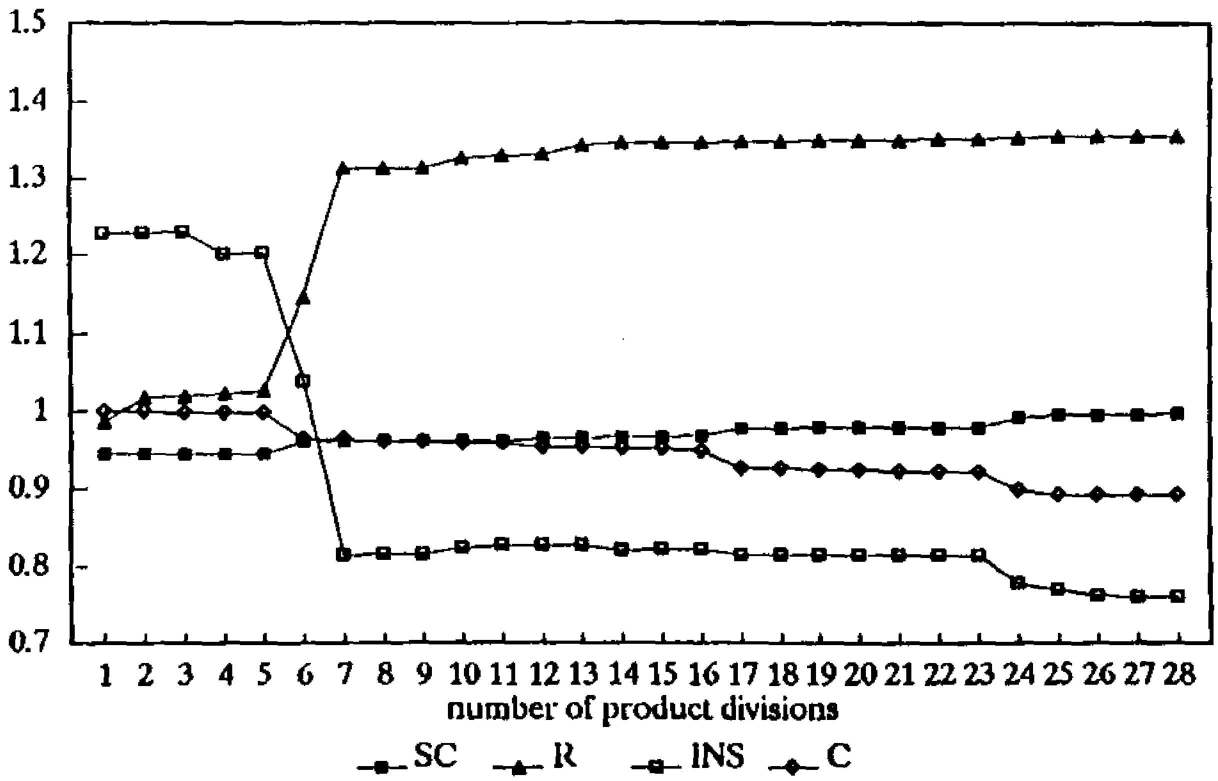


Table 8.PH & Chart 2.PH Simulation results -- Tape II test

(Philippine) (6 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.4430	1.1632	2.2185	15	0.4414	0.9376	1.4692	1.2560
2	0.9725	0.4492	1.2536	1.9752	16	0.4413	0.9378	1.4692	1.2572
3	0.9709	0.4496	1.3683	2.0838	17	0.4412	0.9378	1.4701	1.2398
4	0.9643	0.4512	1.2767	2.3161	18	0.4405	0.9386	1.4708	1.2412
5	0.9600	0.4522	1.2975	2.3735	19	0.4404	0.9387	1.4707	1.2416
6	0.4898	0.8892	1.3843	1.1908	20	0.4404	0.9388	1.4716	1.2363
7	0.4886	0.8903	1.4508	1.4067	21	0.4400	0.9391	1.4731	1.0928
8	0.4886	0.8903	1.4510	1.4002	22	0.4399	0.9392	1.4734	1.1124
9	0.4821	0.8964	1.4501	1.3994	23	0.4399	0.9392	1.4734	1.1126
10	0.4642	0.9139	1.4591	1.2199	24	0.3937	0.9971	1.4711	1.1378
11	0.4623	0.9157	1.4624	1.2939	25	0.3934	0.9975	1.4725	1.0984
12	0.4622	0.9158	1.4627	1.2929	26	0.3933	0.9976	1.4727	1.0973
13	0.4609	0.9171	1.4704	1.2913	27	0.3928	0.9982	1.4727	1.0975
14	0.4414	0.9376	1.4638	1.2560	28	0.3914	1	1.4771	1.0989

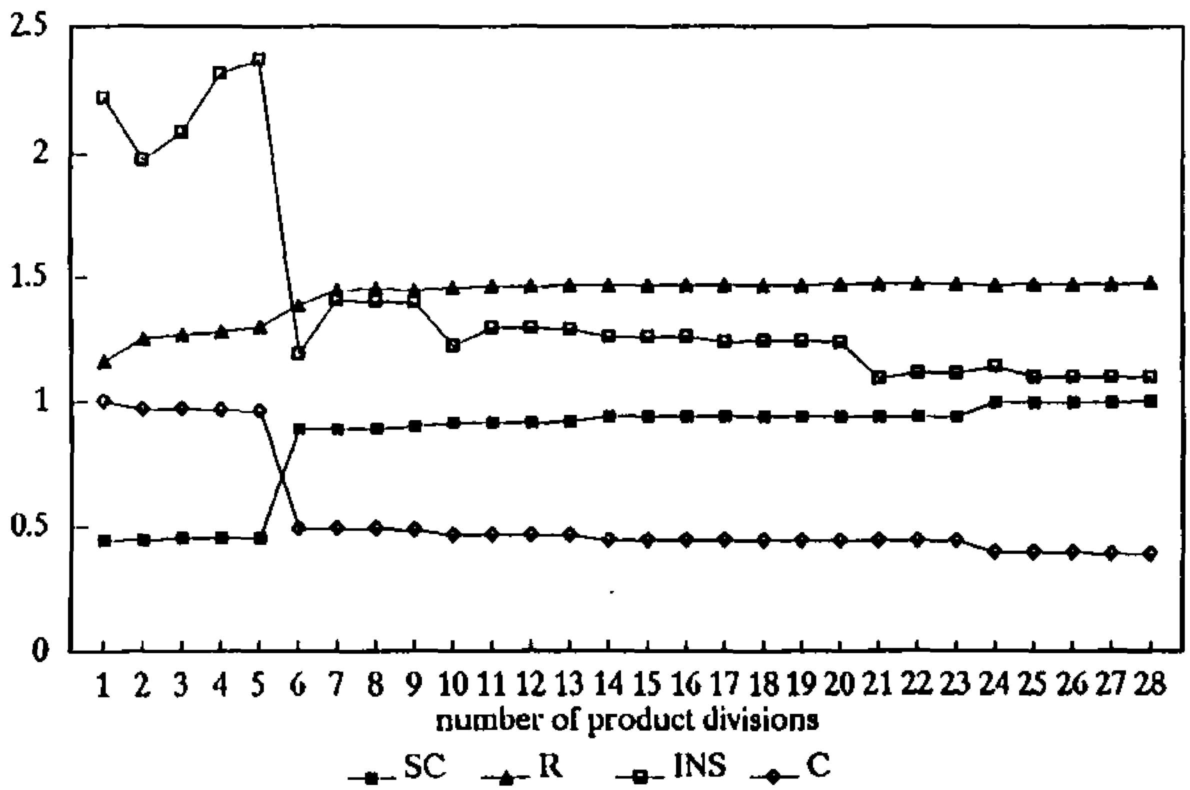


Table 8.SI & Chart 2.SI   Simulation results -- Tape II test

(Singapore)   (7 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.3144	1.5801	2.8454	15	0.3917	0.5562	1.9482	3.7677
2	0.9956	0.3151	1.5969	2.8409	16	0.3804	0.5646	1.9462	3.7060
3	0.9931	0.3155	1.5975	2.8512	17	0.3740	0.5695	1.9462	3.6903
4	0.7330	0.3734	1.5923	3.4456	18	0.3689	0.5734	1.9452	3.6861
5	0.7315	0.3738	1.5938	3.4068	19	0.3593	0.5811	1.9453	3.7041
6	0.6618	0.3937	1.8521	4.7733	20	0.2737	0.7100	1.9106	3.4667
7	0.6613	0.3939	1.8545	4.7781	21	0.2734	0.7103	1.9108	3.4642
8	0.6588	0.3946	1.8550	4.7164	22	0.2733	0.7105	1.9107	3.4649
9	0.6259	0.4050	1.8783	4.2177	23	0.2223	0.8235	1.8861	2.6022
10	0.6140	0.4090	1.8826	4.2220	24	0.1831	0.9684	1.8585	2.3571
11	0.6002	0.4137	1.8814	4.1996	25	0.1824	0.9704	1.8585	2.3396
12	0.4013	0.5494	1.9439	3.9018	26	0.1821	0.9712	1.8584	2.3395
13	0.4002	0.5502	1.9499	3.8841	27	0.1820	0.9713	1.8584	2.3366
14	0.4000	0.5504	1.9499	3.8827	28	0.1726	1	1.8540	2.3312

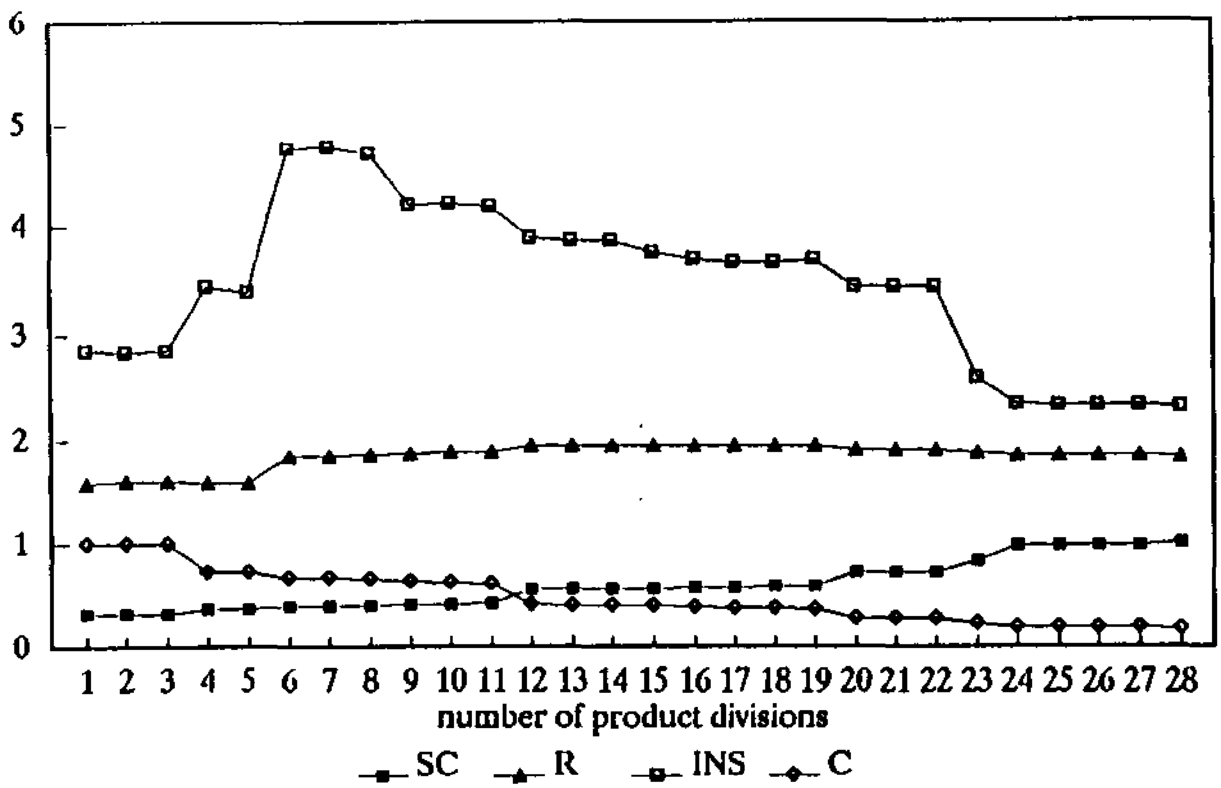


Table 8.TA & Chart 2.TA Simulation results -- Tape II test

(Taiwan) (8 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.2825	1.3593	2.0502	15	0.2560	0.7197	1.8158	0.7332
2	0.9315	0.2929	1.5304	1.8944	16	0.2156	0.8058	1.7974	0.7682
3	0.9204	0.2947	1.5738	1.7915	17	0.2155	0.8060	1.7975	0.7672
4	0.9015	0.2978	1.6426	1.8774	18	0.2079	0.8214	1.8061	0.7679
5	0.7797	0.3213	1.6920	1.1622	19	0.2078	0.8215	1.8064	0.7677
6	0.4464	0.5100	1.6853	0.7766	20	0.2078	0.8216	1.8064	0.7682
7	0.3607	0.5788	1.7482	0.7497	21	0.1992	0.8400	1.8061	0.7665
8	0.3536	0.5846	1.7504	0.7476	22	0.1987	0.8412	1.8065	0.7686
9	0.3531	0.5850	1.7504	0.7484	23	0.1984	0.8419	1.8064	0.7690
10	0.2768	0.6906	1.7685	0.7402	24	0.1662	0.9809	1.7865	0.7488
11	0.2749	0.6929	1.7743	0.7199	25	0.1656	0.9826	1.7887	0.7472
12	0.2739	0.6943	1.7763	0.7245	26	0.1656	0.9827	1.7889	0.7473
13	0.2732	0.6951	1.8200	0.7367	27	0.1648	0.9851	1.7889	0.7482
14	0.2561	0.7196	1.8152	0.7304	28	0.1602	1	1.7873	0.7571

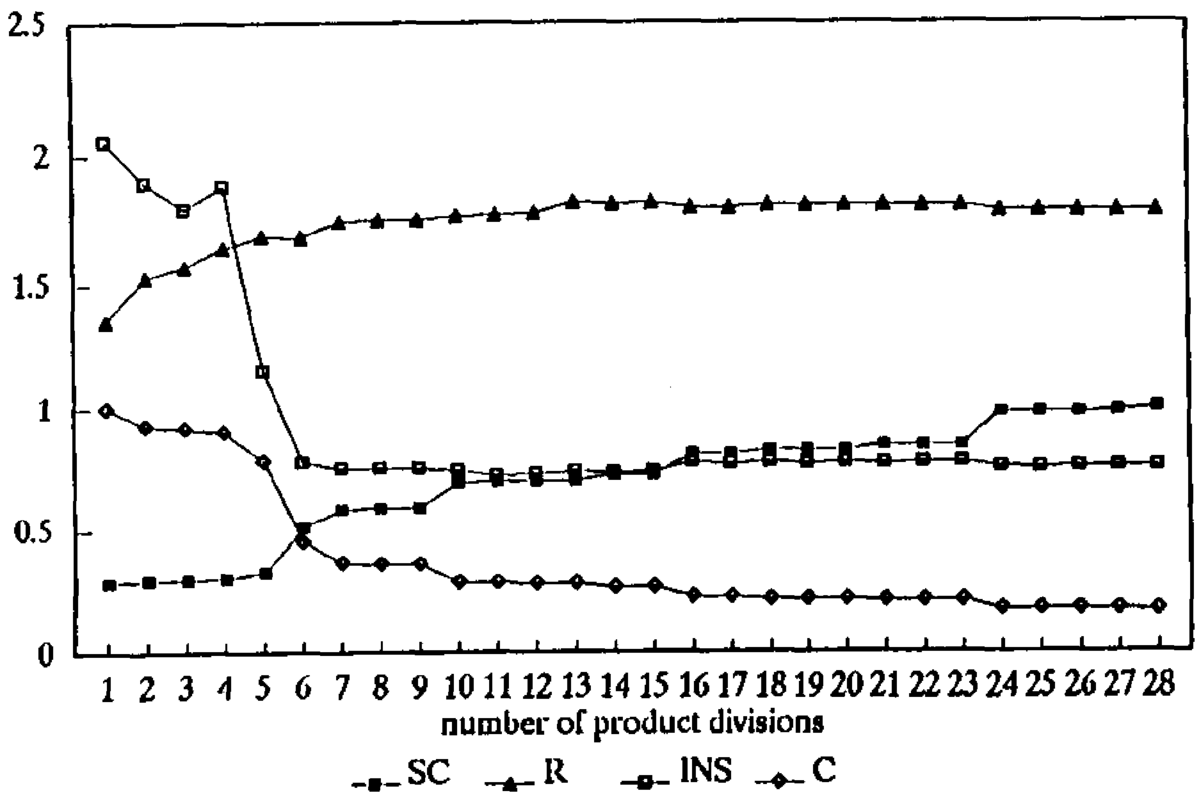
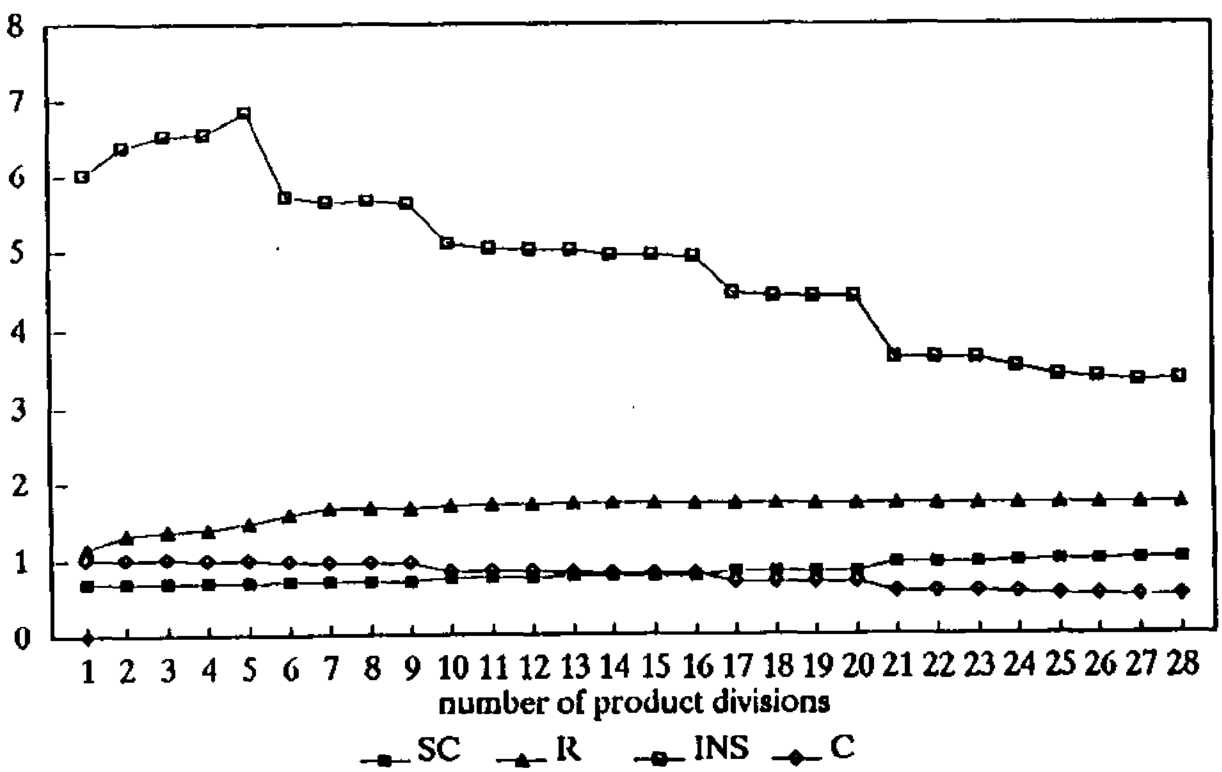


Table 8.TH & Chart 2.TH Simulation results -- Tape II test

(Thailand) (9 of 9)

#	C	SC	R	INS	#	C	SC	R	INS
1	1	0.6908	1.1517	6.0121	15	0.8100	0.7698	1.7466	4.9561
2	0.9988	0.6912	1.3273	6.3831	16	0.8089	0.7703	1.7465	4.9516
3	0.9984	0.6913	1.3792	6.5274	17	0.6933	0.8358	1.7355	4.4949
4	0.9899	0.6943	1.3910	6.5339	18	0.6864	0.8400	1.7387	4.4544
5	0.9895	0.6945	1.4833	6.8296	19	0.6856	0.8404	1.7387	4.4503
6	0.9717	0.7008	1.6002	5.7220	20	0.6854	0.8406	1.7387	4.4492
7	0.9604	0.7049	1.6704	5.6463	21	0.5524	0.9472	1.7361	3.6815
8	0.9601	0.7051	1.6708	5.6470	22	0.5521	0.9475	1.7363	3.6758
9	0.9595	0.7053	1.6709	5.6376	23	0.5520	0.9476	1.7362	3.6750
10	0.8377	0.7569	1.7149	5.1107	24	0.5345	0.9632	1.7360	3.5729
11	0.8324	0.7593	1.7184	5.0384	25	0.5051	0.9917	1.7401	3.4502
12	0.8316	0.7597	1.7208	5.0326	26	0.5032	0.9936	1.7409	3.4362
13	0.8222	0.7641	1.7468	5.0229	27	0.4975	0.9992	1.7400	3.3918
14	0.8105	0.7696	1.7462	4.9580	28	0.4968	1	1.7421	3.3959



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