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Relative Impacts of Quantitative and Qualitative Indicators of International Competitiveness

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Abstract

This paper provides an analysis of the relative impacts of quantitative (micro-level) and qualitative (macro-level) factors that determine a country's international competitiveness. Utilizing a *total factor productivity* approach that depicts competitiveness as the relative ability of a country's industries to make efficient use of their resources to produce and market products at globally competitive prices, the study classifies the determining parameters of competitiveness in terms of the two categories of quantitative and qualitative factors. It then applies data from a sample of five U.S. manufacturing industries to carry out an empirical analysis to verify the relative impacts of these two categories of competitiveness indicators on the country's state of international competitiveness. The results are useful for a determination of relevant policy parameters that would be helpful for stabilizing a country's long-term international competitiveness in an increasingly competitive global economy.

1. Introduction

A country's state of international competitiveness can be examined by utilizing a structural model that decomposes competitiveness into its quantitative micro-level and qualitative macro-level indicators. A country's international competitiveness involves factors ranging from increasing productivity and advancement of research and development (Stone and Ranchhold, 2006), to obtaining high trade surpluses, advancement in high-technology products, and maintaining a highly-trained labor force.[1] These parameters suggest that a country's state of competitiveness is a situation that could be retained, improved, or lost, over time.

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And the ability to achieve and retain competitiveness would depend on the ability to effect the required and appropriate measures and to implement the needed policy actions.

In a free-trade world in the era of globalization, it seems the "survival of the fittest" is increasingly becoming the ultimate rule of the international trade game. The game involves players made up of firms from various countries, and the field of play is the world market. However, to survive and remain in the game, each player must maintain fitness -- the ability to sustain production and marketing of its products at relatively competitive prices and quality in the face of stiff competition from other players. The ability to maintain fitness in this setting is the "competitive advantage" of the firm, and by extension, of the home country from which the firm operates. A country's international competitiveness is *created* from the efficient allocation, rather than *inherited* through the abundant acquisition, of resources (Stone and Ranchhod, 2006; Thompson, 2003). This is even more so because the existence of abundant resources (such as the abundant supply of cheap labor or raw materials) is often met with a lax reliance on the advantages of such abundance, resulting in their inefficient deployment. However, if firms are faced with an inherent disadvantage of relative scarcity problems of high costs of land, labor, or raw materials, they would have no other choice than to *innovate* and *upgrade* in order to survive in a competitive global market environment (Pitelis, 2003). It is in the course of this continuous innovation that the firm may enhance its competitive advantage and international competitiveness.

Porter (1990) had noted that companies succeed in international markets by acting to achieve and maintain competitive advantage through innovation, carried out by adopting new methods and new technologies for product design, production processes, marketing, and general operations. And once competitive advantage has been achieved through innovation in these areas, companies can strive to sustain that advantage only through improvements upon the preceding achievements relentlessly. This is because, as Porter pointed out, almost any advantage that any firm achieves at any time can be imitated, so that global competitors are apt to eventually overtake any firm that relents upon improvements and further innovation -- the dynamic process of *upgrading*.

The Global Competitiveness report of the World Economic Forum has stressed that competitiveness is not only an important determinant for the well-being of states in an international trade environment, but also that competitiveness is crucial for any economy that must rely on international trade to balance its needs for export markets, industrial inputs, energy, and foreign direct investment inflows.

The process through which a firm generates competitive advantage is a short-run process which forms part of the general attributes of the firm's operational objective. This process involves the *quantitative* factors that shape the firm's ability to achieve international competitiveness. But there are also the *qualitative* factors that impact the firm's ability to sustain competitiveness. In this study we explore these factors and examine their relative degrees of effect in the analysis of the country's state of international competitiveness.

2. Indicators of Competitiveness: Some Previous Literature

Significant interest developed around the subject of the relative international competitiveness of nations since Porter (1987, 1990) drew attention to it, within both the academic and business circles. The issues raised at that time, basically centred around the question of how a country could effectively play the "strategic" trade game, and succeed in being able to exact high levels of "gains from trade" relative to its trading partners, within the world market stage. This model simply amounted to the application of the so-called *New Trade Theory* in formation of national and international trade policies. It offers an explanation of what makes some countries more successful than others in terms of their relative strategic trade positions, and their relative abilities to outwit each other in the global market place.

Thompson (2003) applied an explanatory factor analysis to derive a statistically robust index of ten scales representing components of Hong Kong's competitive advantage, but lamented about the uncertainty of exactly what such indices should be measuring, because, as he states, "the concept of competitiveness as applied to economies has no clear or agreed definition among scholars", and moreover there is no "consensus regarding the factors that contribute to national competitiveness." Yet, due to the overwhelming importance of this apparently "vague and ill-measured" concept that governments and public policy makers have incorporated into public expenditure policy objectives, it is very important that an objective and practical method for identifying national competitiveness be found.

Dilek and Kilitciogly (2013) have observed that most studies on competitiveness have tended to concentrate on the measurement of competitiveness at the national (macro) level while neglecting firm (micro) level competitiveness. While this may not be seen as a direct apparent reference to the notions of qualitative and quantitative indicators, respectively, of a country's international competitiveness, the authors called for the need to fill what they perceived as a void. They applied the theoretical base of the measurement of firm level competitiveness that is drawn from two national competitiveness models (namely, the *World Competitive Yearbook,* and the *Global Competitiveness Index*), to assess the relative competitiveness of ten firms, and thereby determined a useful approach for measuring firm level competitiveness -- an approach that can be useful for undertaking comparative competitiveness measures among various business firms within the country. It is apparent that competitiveness at the firm level involves both the qualitative and quantitative variables of competitiveness.

A recent empirical study by Yeganey (2013) can be seen as one that is focused on the impact of the qualitative variables. While controlling for the effects of socioeconomic development, the work highlights the impacts of culture, religiosity, autonomy, and hierarchy, on the one hand (factors that promote competitiveness), and egalitarianism, harmony, and conservatism, on the other (factors that impede competitiveness). It concludes by singling out religiosity by itself regardless of the religious denomination concerned, among all the qualitative factors, as the factor that presents a very serious hindrance to national competitiveness. And the study is complemented by Waheeduzzaman (2011) who explored the competitiveness and convergence of the G7 and big emerging markets (BEM) nations using various economic, demographic, trade, investment, and freedom and governance criteria. The two groups of nations, G7 and BEM, were compared on the basis of various longitudinal variables (GDP and per capita GDP growth, international trade, foreign direct investment, index of ageing, and life expectancy at birth), and cross-sectional variables (competitiveness index, index of economic freedom, democracy index, human development index, gini index, government effectiveness, and corruption perception index). It found that the BEM countries were growing faster than the G7 in most economic indicators including GDP, trade, and investment; and that the growth resulted in some form of convergence.

It has been asserted that little empirical work exists on the impact of manufacturing on a nation's competitiveness (Pitelis and Antonakis, 2003).

This study found that changes in manufacturing shares have a positive and significant impact on competitiveness measured by the growth in per capita income. This provides a support for the inclusion manufacturing sector variables in the choices of potential quantitative indicators of a country's competitiveness. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets.

The present study is an attempt to further the Pitelis and Antonakis (2003) approach by applying data from a sample of five U.S. manufacturing industries to examine the relative impacts (if any) of micro-level quantitative factors, and macro-level qualitative factors, in determining the level of the country's international competitiveness.

3. Theoretical Framework

Conceptually, two classifications of levels of international competitiveness exist, namely, competitiveness at the *micro level* involving quantitative parameters; and competitiveness at the *macro level* involving qualitative parameters. These coincide, respectively, with the *necessary* (quantitative) factors, and the *sufficiency* (qualitative) factors of international competitiveness. The components of the quantitative factors are the micro-level indexes, namely, productivity, technology, and cost efficiency; and the qualitative factors consist of the macro-level parameters made up of institutional factors and infrastructure.

3.1. Micro Level Indicators of Competitiveness

Global competitiveness may generally be defined in terms of technology and scale: a country is competitive if its industries have an average level of *Total Factor Productivity* (TFP) greater than or equal to that of its foreign competitors (see Porter, 1990; Markusen, 1992). This aspect of international competitiveness may also be depicted in terms of costs: a country is competitive if its industries have an average level of unit costs (average costs) lower than or equal to that of its foreign competitors (Rao and Lempriere, 1992; Dollar, 1993).

Thus, factor productivity and cost efficiency indicate *quantitative* aspects of the determinants of international competitiveness. Productivity relates output to inputs, and represents the closest measure of the efficiency of the production process. Productivity is quantifiable and measurable; its levels are unique, and remain invariant to any subjective values such as opinions, perceptions, or impressions that could sub-plant its magnitude. Productivity trends could be consistently determined over time for cross-sectional and time series comparisons.

Total factor productivity is the measure of the relationship between output and the combined effects of total factor inputs. The TFP measures the output of the *weighted sum of all inputs*, thereby giving the residual output changes not accounted for by total factor input changes. As the measure of the combined effects of input use, the TFP is a residual measure. Changes in TFP are not influenced by changes in the various factors which affect technological progress, factors such as the quality of factors of production, flexibility of resource use, capacity utilization, quality of management, economies of scale, and the like. Also, changes in TFP are not influenced by efficient factor substitutions induced by changes in relative factor prices and product demand conditions. Therefore, such changes are the measures of the efficiency (productivity) with which all factors are used in the production process.

3.2. Macro Level Indicators of Competitiveness

The macro level indicators are comprised of factors that are not unique to any particular firm or industry, but rather affect the economy as a whole. These include the variables of government policy actions (such as tax policy, labor market policy, exchange rate regime adopted, and financial sector regulatory or deregulatory policies), and the existence and adequacy of infrastructure. There also are the availability (or stability) of other institutional parameters such as legal, educational, health and paramedical, and financial infrastructure.

The degree of "economic liberalization" provided and allowed by the country’s authorities, and existence of adequate institutional framework in a country are crucial factors that influence the country's state of competitiveness. These factors, however, hang largely on the political and (ideological) leaning of the country's authorities and policy makers -- policies that usually remain fairly unchanged over time. These macro parameters tend to be constant over time.

A country's competitiveness is depicted in the functional relationship:

$$Compt = f(\eta X + \lambda Z) \quad (1)$$

where

X = the composite vector of quantitative indicators,
Z = the composite vector of qualitative indicators, and

η, λ = weighting indexes of the quantitative indicators and the qualitative indicators of competitiveness, respectively.

This model allows us to formulate some testable predictions about the relative roles of the various determining micro and macro parameters impact a country's state of competitiveness. It provides a framework that measures competitiveness from the standpoint of micro level parameters (such as industry unit labor costs, rate of innovation, efficiency of management, and capacity utilization), and macro level factors (such as corporate tax rate, currency exchange rate, state of infrastructure, and level of economic regulation). The model enables us to construct the empirical framework for testing the strength and reliability of these relationships.

4. Empirical Analysis

We apply mainly time-series data from the Bureau of Economic Analysis of the U.S. Bureau of Census, the Bureau of Labor Statistics, and the Conference Board Total Economy Database, to verify the impacts of the respective qualitative and quantitative indicators on international competitiveness. A mix of five U.S. manufacturing industries are sampled, namely, automobile, textile, plastic products, electrical equipments, and chemicals. The dependent variable is the index of competitiveness, measured by the total factor productivity growth per time period. The independent variables are comprised of two composite groups: (1) the quantitative variables, made up of the firm/industry level parameters of unit labor cost, growth rate of innovation (expenditure on Research and Development programs), management efficiency (proxied by profit growth rate), labor unionization (percentage of employed labor force unionized), and capacity utilization rate; (2) the national level qualitative variables, made up of the corporate tax rate, the exchange rate of the U.S. dollar (relative to the currency of U.S.

Largest trading partner -- the Canadian dollar), state of infrastructure (dummy variable), financial sector regulation (dummy variable), and stability of socio-economic institutions (dummy variable).

The linear specification of the model is given as

$$Compt = \beta_0 + \beta_i \sum X_i + \gamma_i \sum Z_i + \varepsilon \quad (2)$$

where,

COMPT = the level of competitiveness, and
X_i = vector of the micro level variables comprised of:
ULC = the firm/industry unit labor cost,
INNOV = growth rate of innovation,
EFFIC = management efficiency,
UNION = labor unionization level,
CAPAC = capacity utilization rate.
And Z_i = vector of macro level variables comprised of:
TAX = the corporate tax rate,
EXCH = the exchange rate,
INFRA = state of infrastructure,
REGUL = financial sector regulation,
SOCIO = stability of socio-economic institutions.

β_i's, γ_i = parameter estimates; ε = error term.

The sign expectations of the various explanatory variables helps provide a preliminary indication of the paper's central intuition regarding the impact of the explanatory variables, especially the Z-variables. It is expected that the parameter estimates for the various explanatory variables be as follows:

- ULC be negative (higher average cost of production results in lesser competitiveness).
- INNOV be positive (greater innovation yields greater competitiveness).
- EFFIC be positive (greater efficiency of management results in greater competitiveness).

- CAPAC be positive (higher firm/industry capacity utilization results in greater competitiveness).
- The parameter estimates of the Z-vector are expected to be positive or negative according to the nature of the particular attribute concerned (for example, the coefficient for taxation is expected to be negative as higher business taxes are disincentives to investment and innovation; that of unionization is expected to be negative due to the high non-wage costs associated with organized labor). The coefficient of INFRA is expected to be positive; that of EXCH is expected to be negative; and those of REGUL and SOCIO are expected to be negative and positive, respectively.

4.1. The Data Set and Estimation

The data was collected from the 2012 U.S. Bureau of Census (Bureau of Economic Analysis) and Bureau of Labor Statistics pool, and the 2013 Conference Board Total Economy Database. Several proxies have been applied in the data used in the estimations due to the nature of the variables, although data on many of the variables are available directly. Data on the variables of competitiveness (COMPT), industry unit labor costs (ULC), capacity utilization (CAPAC), corporate tax rate (TAX), labor unionization (UNION), and the exchange rate (EXCH), are available directly. However, data on the variables of innovation and technological progress (INNOV) is proxied by the level of expenditures on research and development and employee retraining; and management efficiency (EFFIC) is proxied by profit growth rates. Table 1 provides the descriptive statistics of the means for each variable used in the estimations. The equations are estimated using OLS procedure.

Table 1: Descriptive Statistics of Industry Competitivess Indicators (Sample Means)

	Automobile	Textile	Plastics	Electricals	Chemicals
COMPT	1.26	0.93	0.45	2.7	1.98
	(3.7)	(1.4)	(1.8)	(2.3)	(1.6)
ULC	32.5	7.2	9.4	18.6	24.2
	(11.2)	(6.1)	(4.9)	(12.3)	(6.5)
CAPAC	0.89	0.92	0.96	0.93	0.95
	(0.52)	(0.28)	(0.35)	(0.56)	(0.49)
TAX	0.33	0.32	0.34	0.30	0.29
	(0.19)	(0.26)	(0.11)	(0.17)	(0.14)
UNION	0.86	0.24	0.18	0.65	0.42
	(0.60)	(0.49)	(0.23)	(0.57)	(0.39)
EXCH	1.08	1.06	1.08	1.02	1.04
	(0.05)	(0.03)	(0.01)	(0.04)	(0.03)
INNOV**	243	68	17	118	71
	(8.2)	(2.6)	(3.4)	(7.9)	(3.8)
EFFIC	0.03		0.019	0.02	0.04
0.018					
	(0.19)	(0.26)	(0.11)	(0.17)	(0.14)

Key: Standard Deviations in parenthesis.

N = 18
** $million.

4.2. The Results

The estimation results are presented in Tables 2 and 3. The high values of the F-ratios indicate an overall significance.

The values of the R^2 appear moderately low in the case of the macro level (z) relative to the micro level (x) variables for which they uniformly indicate a good fit; the relatively low R^2 for the z-variables could possibly be a result of some autocorrelation in the time-series data utilized for the regression. However, despite the high F-ratios, pairwise correlation tests of the presence of multicollinearity were performed among the independent variables (especially ULC, CAPAC, INNOV, and EFFIC) to ascertain the reliability of their estimated coefficients. A weak correlation coefficient (0.2256) was found among them. We examine these results by looking at them separately according to the variable groups in terms of the micro level variables (ULC, CAPAC, UNION, INNOV, and EFFIC), and the macro level variables (TAX, EXCH, INFRA, REGUL, and SOCIO).

Table 2 presents the regression estimates of the micro-level competitiveness indicators across the chosen representative manufacturing industries. The coefficient parameter estimates all yield the correct and expected signs; and we shall interpret the magnitude of a coefficient estimate as indicator of the strength of the effect of the variable. The coefficients of the unit labor cost of output (ULC) and labor unionization (UNION) variables appear to indicate the very significant roles that these two variables play in shaping the international competitiveness of the U.S. manufacturing sector. In particular, as these variables are the key ones that lie entirely within the control of the firm, it reveals how deeply the industry's competitiveness is determined by the labor costs and labor relations issues at the industry level.

Table 2: Regression Estimates of Competitiveness Indicators: Micro Level Variables

	Automobile	Textile	Plastics	Electricals	Chemicals
CONST	2.28 (3.4)	3.02 (2.5)	1.92 (3.8)	2.08 (1.9)	3.04 (2.6)
ULC	-5.62** (3.1)	-3.91** (2.3)	-1.88** (3.9)	-2.19* (1.9)	-0.94** (4.1)
CAPAC	0.98** (4.29)	1.89 (1.80)	2.06** (2.65)	2.14 (1.86)	1.92** (2.79)
UNION	-5.33** (3.60)	-1.06** (2.49)	-1.92** (2.23)	-2.43 (1.57)	-1.81 (2.39)
INNOV	1.8** (4.2)	1.5** (2.6)	2.01** (3.4)	0.90** (2.9)	0.62** (3.1)
EFFIC	2.09 (1.79)	2.32** (2.26)	1.88* (2.11)	2.02** (2.17)	2.41* (1.84)
R^2	0.78	0.83	0.76	0.69	0.71
F	39.2	24.8	16.9	22.1	20.6
N	18	18	18	18	18

Notes: t-statistics in parenthesis.
**Significant at 5% level.
*Significant at 10% level.

Table 3: Regression Estimates of Competitiveness Indicators: Macro Level Variables

	Automobile	Textile	Plastics	Electricals	Chemicals
CONST	1.26	0.93	0.45	2.7	1.98
	(3.7)	(1.4)	(1.8)	(2.3)	(1.6)
TAX	-3.5**	-1.2**	-2.3**	-1.6**	-1.2
	(4.2)	(3.6)	(2.9)	(2.3)	(1.5)
EXCH	-0.89**	-0.92**	-0.94	-0.82**	-0.85
	(2.52)	(2.98)	(1.65)	(2.56)	(1.49)
INFRA	0.86		0.24	0.18	0.65
0.42**					
	(1.60)	(1.19)	(0.93)	(1.57)	(2.39)
REGUL	-2.3**	-1.8**	-1.7**	-0.9**	-1.02**
	(3.2)	(2.6)	(3.4)	(4.9)	(3.8)
SOCIO	0.03*	0.02	0.07*	0.04	0.018
	(1.91)	(1.26)	(1.82)	(0.87)	(0.94)
R^2	0.62	0.59	0.68	0.66	0.54
F	11.5	8.9	12.4	13.1	9.7
N	18	18	18	18	18

Notes: t-statistics in parenthesis.
**Significant at 5% level.
*Significant at 10% level.

The estimated coefficients of the capacity utilization variable indicate an important role for industry capacity utilization in shaping the country's competitiveness, with magnitudes averaging about 2.0, and significant at the 5 percent level for the automobile, plastics, and chemical industries (though not significant for the textile and electrical industries).

This suggests that the country's competitiveness is significantly impacted by the extent to which its domestic industries are able to operate efficiently engage their productive resources. Also, there is a significant impact for the innovation variable -- (averaging about 1.5 in magnitude, and all significant at the 5 percent level). The efficiency of operation variable has even larger estimated coefficients (averaging over 2.1 in magnitude and significant at the 5 percent level for the textiles and electrical industries, 10 percent level for the plastics and chemicals industries, while not significant for the automobile industry). The results indicate that labor unionization, labor costs, capacity utilization, and efficiency of operation are very prominent factors in the nation's international competitiveness; the level of innovation in the industrial sector appears to have a mild effect on competitiveness. And we see that these factors do not seem to have significant inter-industry variations (based on the size of the effects as shown by the magnitudes of the coefficients), nor are the results significantly different for the relatively more capital intensive industries (automobile and electrical) as compared to the relatively labor intensive ones (such as textiles and plastics).

The regression results of the macro level variables are presented in Table 3. The coefficient estimates of the tax variable range from a high magnitude of -3.5 (significant at the 5 percent level for all industries except chemicals), moderate sizes of -2.3 for the plastics industry and -1.6 for electricals, and a low magnitude of -1.2 for textiles and chemicals. Unexpectedly, the exchange rate variable show some relatively less perceptible effect across all the industries (significant at the 5 percent level for all except plastics and chemicals industries); it seems this can be attributed to the special status that the U.S. dollar has in the world market as the currency in which much of the world's international trade are denominated.

The infrastructure variable (with low coefficient magnitudes averaging just about -0.4 and all not significant except for the chemicals industry) does not seem to have a major impact on competitiveness; and so is the socioeconomic variable (with very weak parameter estimates averaging just about 0.036, and all not significant except for the automobile and plastics industries that show significance at the 10 percent level). But the regulation variable with all parameter estimates significant at the 5 percent level, show that the degree of industry regulation does have some significant impact on competitiveness. This is more so in the automobile industry with a coefficient magnitude of -2.3; thereby confirming what is a generally expected trend.

5. Policy Implications and Conclusion

Qualitative and quantitative indicators of international competitiveness are essential specifications that must be determined in order to achieve proper understanding of this important phenomenon. This paper has applied a simple model to assess the relative impacts of quantitative micro-level and qualitative macro-level variables on the international competitiveness of the country. Important policy applications of this study include the realisation that, relative to a country's trading partners, the maintenance of international competitiveness involves several factors ranging from increasing innovativeness and productivity and cost efficiency to maintaining stable socioeconomic and infrastructural institutions. These groups of quantitative and qualitative factors suggest that a country's competitiveness status is a situation that could be retained, improved, or lost, over time. And the ability to achieve and retain competitiveness would depend on the ability to effect the required and appropriate measures, and also to implement the appropriate policy actions designed to maintain these parameters.

The most remarkable conclusion that can be observed from the results of the study is that the country's international competitiveness appears to be impacted more by the micro-level quantitative indicators than the macro-level qualitative indicators. Therefore, to enhance the country's competitiveness it is important to maintain the relevant policies on the factors that impact the appropriate quantitative indicators like labor costs (low payroll tax policy), labor union activities (supportive labor relations rules), innovation (research and development tax breaks and subsidies), operational efficiency (boosting incentives and adequate management compensation). In regard to the qualitative factors, the corporate tax rate to a large extent, the state of regulatory control of industries to a moderate extent, and the exchange rate of the dollar to a lesser extent, appear to be important factors that impact industry competitiveness. Yet these qualitative factors are not as strong in shaping competitiveness as the quantitative factors. But a very interesting result that emanates from the study is that the qualitative indicators like infrastructure and socioeconomic stability do not seem to be as prominent in determining competitiveness as usually reckoned. This observation can be useful toward helping policy makers to focus on the most relevant parameters that can be effective for promoting competitiveness rather than others that have been touted to be important but not really supported by empirical evidence.

Notes

1. A country's international competitiveness is judged in terms of its ability to achieve and maintain a favorable relative position in its international (trade) transactions in the global marketplace. This ranges from having a low-cost domestic production base to attracting consistent large inflows of foreign direct investment. A number of studies assert that a country would be losing international competitiveness if/when it suffers from such factors as poor research and development (R&D) record, a growing trade deficit in high-tech products, an ill-trained labor force, and relatively low productivity (Stone and Ranchhod, 2006; Thompson, 2004; Ezeala-Harrison, 1999, 1998; Moon and Perry, 1995; Porter, 1990).
2. Other parameters of economic liberalization such as degree of privatization, deregulation, and centralization are equally important, and various indices could be employed to measure their levels to assess the degree of economic liberalization. We have selected to use these two (namely, trade liberalization and exchange rate) only on the basis of their being relatively easy to keep track of explicitly.

3. These particular industries are selected merely for convenience of data availability and not for any other particular reason.

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