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F&V Trade Model to assess Euro-Med Agreements. An application to the fresh tomato market

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ABSTRACT OF:

F&V Trade Model to assess Euro-Med Agreements. An application to the fresh tomato market.

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The complexity derived from the bilateral trade liberalisation process in the Mediterranean region is difficult to represent in a trade model, not only because of the range of instruments still constraining trade but also because of the special nature of the most important traded goods (product differentiation and seasonality).

Tariff-rate quotas (TRQ's) and the entry price system are clearly defined on a monthly basis for the fruits and vegetables trade flows towards the European Union (EU). This point makes efforts to model such a trade in yearly basis not representative of reality.

We propose a static partial equilibrium model tailored to model trade impacts of specific policy instruments which considers imports from different sources as imperfect substitutes, following the non-linear Armington type model.

Different policy scenarios have been run using the model, considering changes in TRQ's and Entry Price regimes, its tariffication and preference erosion.

The results of model runs show that, as regards to EU producers, bilateral trade liberalisation with extension of TRQs would be the least dramatic scenario. By contrast, the phasing out of the entry price system would have serious consequences on EU producers. The model has also given detailed information on Morocco's interests in the negotiation, although it could easily include a larger number of suppliers. Morocco appears to be interested in multilateral liberalisation as well as in bilateral liberalisation. In fact, multilateral liberalisation will not cause a great deal of preference erosion against Moroccan exporters, unless tariff reductions only affect MFN suppliers.

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1. Introduction

The analysis of regional trade liberalisation remains an interesting area of research. A large number of countries are taking part in preferential agreements. This is also true for the Mediterranean region.

Complexity is a word that defines the bilateral trade liberalisation process in the region. This complexity is difficult to represent in a trade model, not only because of the range of instruments still constraining trade but also because of the special nature of the most important traded goods (product differentiation and seasonality).

The commercial integration process among the European Union and a number of countries from the Mediterranean basin has been making progress during last years, within the framework launched in the 1995 Barcelona Conference (see Garcia-Alvarez-Coque, 2002). Within this framework, the EU holds preferential trade agreements (PTAs) with its Mediterranean neighbour countries -or Southern Mediterranean Countries (SMCs)- in the path towards the establishment of the EMFTA. The process is quite dynamic and not all SMCs are in the same stage of implementation of their corresponding FTA (ideally, to be completed by 2010).

One major fact of the EMFTA is that there is one major sector that is still excluded from the free trade area provisions: agriculture. The five year programme agreed in the Barcelona Mediterranean Conference (27-28 November 2005) foresees the progressive liberalisation of trade in agriculture, but *“with a possible selected number of exceptions and timetables for gradual and asymmetrical implementation, taking into account the differences and individual characteristics of the agricultural sector in different countries”*.

In terms of analysing the EMFTA, the fact that a number of countries are negotiating with the EU and implementing agreements at a various stages makes it difficult to model the trade effects of the Euro-Mediterranean FTAs. Furthermore, actual preference

margins enjoyed by one specific third country in the EU are depending on the preferences granted to other third countries. Consequently, the results of modelling efforts can hardly be considered as forecasts of future developments. They rather reflect or simulate the size of the potential economic impacts, depending on the nature of the preferences granted.

- *Preferences and TRQs.* The formal structure in all EMAs is very similar, although they may differ in the specific quantitative parameters of trade concessions in agriculture (tariff reduction, products covered and quantitative limits). However, tariff concessions are limited to negotiated quantities for a number of “sensitive” products. TRQs can easily neutralise the market access theoretically improved by tariff preferences.
- *Entry prices.* The entry price system applies to a group of fruits and vegetables considered particularly sensitive by the EU. It guarantees that imports are not sold on EU markets below a ‘minimum entry price’. This system is in contradiction with the spirit of tariffication. Third countries apparently accepted this approach as a *quid pro quo* for the continuing opportunity to export to the EU at high prices without facing high tariffs. Significant reductions of entry prices for limited quantities of some products have been negotiated and agreed with Morocco, Egypt and Israel, creating a preference margin.
- *Seasonal windows.* In some periods of the year the EU market seems to be more open to foreign trade than in other periods. A yearly approach for modelling F&V trade flows could hardly catch the complexity of this seasonal regulation and its practical consequences. For this reasons, a model will have as one of its features a seasonal definition of the unknowns, allowing us to make a detailed representation of the changing trade policies that export supplies are facing.

In horticultural markets, non-price factors matter. It is striking that for some products, the actual exports by SMCs to the EU have been below the quantitative limits, suggesting supply constrains faced by these countries but also the fact that the demand is differentiated by quality/origin. This is probably good news for Southern European farmers. In general, for products like fresh fruit and vegetables it is not easy to transform theoretical market opportunities into concrete market realities.

In brief, our intention is to propose a model approach which joins the following characteristics:

1. It is a partial equilibrium model, tailored to model trade impacts of specific policy instruments.
2. It considers imports from different sources as imperfect substitutes, which can be undertaken through and a non-linear Armington (1969) type model.
3. The market modelled is the EU-25.
4. The composite demand is formed by different sources, including the intra-EU25 sources plus the most important EU-25 suppliers. The pilot model for tomato, for example, takes the EU-25, Morocco and the Rest of the World (ROW) as major suppliers. The extensions of the model easily increase the number of supply regions.
5. The projections are based on comparative static simulations. In the first versions of the model, there is no significant interdependence between consuming and producing decisions between any given pair of monthly periods. A certain degree of dynamism is included through a shifter to be applied on the supply and demand equations. Future versions of the trade model will define more complex structure on monthly price expectations, which consider monthly production and consumption across the year as the result of a one step choice.

The F&V model draws on the existing knowledge, mainly based on the methodological basis presented by Francois and Hall (1997)¹. Nevertheless, our model offers a value-added by a detailed specification of policy impacts through:

1. A detailed specification of policy measures. Thus, the model has to be able to make explicit representation of:
 - TRQs
 - MFN Entry prices
 - Entry prices agreed with selected Mediterranean partners
 - Ad valorem and additional tariffs applied to certain F&V
2. Specific estimation of policy impacts on a seasonal basis, if possible at the monthly level.

¹ A similar approach, though using linear equations can be found in Sarris (1983).

2. Model equations

Let us define the main model variables and parameters:

P_j is the internal price of good originating at j

P is a composite index of internal prices of product originating at various sources.

W_j is the export price of good originating at j

α_i is the allocation parameter to aggregate imports from different sources.

E is total expenditure on EU imports at internal prices.

k^M is a constant term for the demand for total imports

k^E_j is a constant term for the export supply of good originating at j

σ is the elasticity of substitution

t_j^o is the extra-quota total duty (or the only duty when TRQ is not defined)..

t_j^w is the price wedge on country j imports.

η is the demand for total imports, including intra-EU and extra-EU partners' goods.

μ_j is the export supply of good originating at j to the EU market.

M^q_j is the total quota volume for product originating at j

M_j = import flow originating at j

q = total composite demand.

X_j = export flow originating at j

Model description

For the sake of easing the model description, we assume in the next equations that preferential suppliers are not constrained by tariffs (though they could be restricted by TRQs). However, the model extension to the case where tariffs also apply to preferential suppliers is straightforward. Moreover, the actual empirical exercises are based on the fact that preferential suppliers are actually facing tariffs.

Demand side:

We first define the composite good, q , as a CES composite of intra-EU good and imports from different regions. Total composite good demand can be described by a demand standard equation:

$$q = k^M P^\eta \quad [1]$$

The price P is an index of prices of the imports originated at various regions:

$$\text{Import price index: } P = \left[\sum_{i=1}^n \alpha_i^\sigma P_i^{1-\sigma} \right]^{1-1/\rho}, \text{ where } \rho = (\sigma-1)/\sigma$$

While equation [1] represents the total EU import demand, i.e., for tomato, we need to describe the specific demand for imports from the considered regions. Thus, the import demand of good originating at region j is:

$$M_j = \left[\frac{\alpha_j}{P_j} \right]^\sigma P^{\sigma-1} E \quad [2]$$

Consequently, the demand side is defined by a composite import demand plus specific demands for imports from different exporting regions.

Supply side:

Supply functions are specified as a function with constant supply elasticity. Again, imports originating at various regions are separately modelled. Thus, supply of imports originating at j :

$$X_j = k_j^E [W_j]^{\mu_j} \quad [3]$$

The relation between internal prices and export prices being this:

$$W_j = \frac{P_j}{(1 + t_j^w)}$$

where $t_j^w \leq t_j^o$.

Note that a price wedge is defined when imports face TRQs. In the basic formulation a preferential supplier not constrained by TRQs, when these are not binding, $t_j^w = 0$. When TRQs are binding, then a price wedge is defined and has to be calculated endogenously. When exports are over the TRQ limits, then the maximum price wedge is applied, which is, for this case, equal to the maximum tariff t_j^o .

Actually, in the first applications of the model, a differentiation is made, for each supplier, between the actual tariff applied, on the one hand, and the price wedge resulting of the implementation of TRQs, on the other.

System equations:

The model is finally constructed through a system of non-linear equation, which can be solved through the use of GAMS programming.

The equations to be solved are:

1. Excess of demand good originating at j must be zero:

$$M_j - X_j = 0$$

Replacing import demand (equation [2]) and import supply (equation [3]) the excess demand condition is:

$$\left[\frac{\alpha_j}{P_j} \right]^\sigma P^{\sigma-1} E - k_j^E [W_j]^{\mu_j} = 0 \quad j = 1, \dots, n$$

Replacing W_j by its value in terms of P_j :

$$\left[\frac{\alpha_j}{P_j} \right]^\sigma P^{\sigma-1} E - k_j^E \left[\frac{P_j}{(1+t_j^w)} \right]^{\mu_j} = 0 \quad j = 1, \dots, n \quad [4]$$

2. Total import demand. This can be expressed as follows:

$$k^M P^{\eta+1} - E = 0$$

Note that the equation above is specified just by multiplying the composite demand for the composite price and rearranging.

3. Total price index:
$$P - \left[\sum_{i=1}^n \alpha_i^\sigma P_i^{1-\sigma} \right]^{1-1/\rho} = 0 \quad [5]$$

Then the system to solve is formed by $n + 2$ equations and $n + 2$ unknown variables (n prices, total expenditure E and composite price P).

TRQs:

As indicated above the price wedge for preferential suppliers can get three kinds of values, depending on the size of imports compared to the applied TRQs. For cases where preferential tariffs are nil:

- a) $M_j < M^q_j$ then $t_j^w = 0$
- b) $M_j = M^q_j$ then $0 < t_j^w < t_j^o$, and t_j^w is estimated endogenously.
- c) $M_j > M^q_j$ then $t_j^w = t_j^o$

Calibration

Calibration is based on unit price normalisation, so that all constants are equal to benchmark expenditures. If a TRQ is binding we have to propose a value for the reference price wedge. However, if $M_j > M^q_j$ then the price wedge is taken as the initial out-of-quota tariff t_j^o .

3. Model application. Policy measures in the benchmark scenario

Tomato is a good illustration and very relevant for the EU agriculture. EU tomato market is a good example of : (i) protection levels which change from a month to the next; (ii) specific border measures, such as entry prices and TRQs; (iii) tariff concessions to Mediterranean countries, in the form reduced “agreed entry prices” and tariff levels.

Modelling preferences with entry prices and TRQs

If we have a look to the Moroccan SIV level compared to the Entry Price level and to the actual Moroccan imports compared to the TRQs, we find a number of reference situations, which reflect the complexity of EU tomato trade policies, even for preferential suppliers. The situations are shown in following table:

Table 1. Reality under the agreement

	Moroccan price:		Actual trade > TRQ ?
	Undercuts MFN EP ?	Undercuts Agreed EP ?	
January	Yes	Yes	Yes
February	Yes	Yes	No
March	Yes	No	Yes
April	Yes	Yes	Yes
May	Yes	No	Yes
June	No	No	No TRQ
July	Yes	Yes	No TRQ
August	No	No	No TRQ

September	No	No	No TRQ
October	No	No	No
November	No	No	Yes
December	No	No	Yes

Source: authors' calculations.

Only in June, August, September and October, Moroccan imports appear not to be constrained by Entry Prices (EP) nor by TRQs. In March, May, November and December, the only constrain is the TRQ, but is clear that in March and May the Moroccan trade is favoured by the reduced agreed EP and that the loss of preference could have serious consequences because the Moroccan price undercuts the MFN Entry Price. In February and July Moroccan exports are constrained by the EP but TRQ are not constraining the import flows. Finally, in January and April, Moroccan trade is constrained by both the EP and the TRQ, and there is not a clear advantage of being a preferential supplier with respect to MFN suppliers.

Although a detailed description of the entry price system can be found in Swinbank and Ritson (1995) and Grethe and Tangermann (1998), we can stress that the fact that there is an Entry price for Moroccan imports (within a quantity limit) and an Entry price for MFN imports leads us to consider three possible situations, in order to calculate the size of the minimum (preferential) tariff t_j^i and maximum tariff t_j^o to be applied to Moroccan imports to the EU market:

- When Moroccan import price > MFN Entry price:

$$t_j^o = x \% \text{ MFN Ad Valorem Tariff}$$

$$t_j^i = 0$$

where “x” refers to an agreed percentage of reduction for preferential suppliers. This percentage of reduction for Moroccan tomato is 60 percent.

- When MFN Entry price > Moroccan import price > Agreed Entry price:

$$t_j^o = x \% \text{ MFN Ad Valorem Tariff} + \text{Additional Tariff}$$

$$t_j^i = 0$$

The additional tariff is the corresponding tariff which triggers when the entry price is undercut. The agreed entry price is the reduced entry price foreseen in the EuroMediterranean Association Agreement.

- Moroccan import price < Agreed Entry price

$$t_j^o = x \% \text{ MFN Ad Valorem Tariff} + \text{Additional Tariff}$$

$$t_j^i = \text{Additional Tariff}$$

This last situation happens when the additional tariff is charged on Moroccan imports because even the agreed the entry price is undercut. Note that t_j^o is the total charge that would be applied on Moroccan imports, if they would not receive the preferential treatment anymore, which is the case, for example, when the TRQ is overcome.

Table 2 shows the monthly effective tariffs t_j^i and t_j^o for Moroccan tomato, which have been calculated from 2004 data, i.e. SIV, entry prices and full tariffs (ad valorem tariffs plus additional tariffs related to the entry price system). Tariffs are expressed in their *Ad Valorem* Equivalents.

Table 2. In-quota and out-of-quota tariffs on Moroccan tomato imports (2004)

Month	t_j^i (% SIV)	t_j^o (% SIV)	SIV with respect MFN and agreed entry prices
January	77,6	81,1	SIV < Agreed EP
February	79,5	83,0	SIV < Agreed EP
March	0,0	41,1	Agreed EP < SIV < MFN EP
April	105,7	109,2	SIV < Agreed EP
May	0,0	52,1	Agreed EP < SIV < MFN EP
June	5,7	5,7	SIV > MFN EP
July	12,1	12,1	SIV < Agreed EP
August	5,7	5,7	SIV > MFN EP
September	5,7	5,7	SIV > MFN EP
October	5,7	5,7	SIV > MFN EP
November	0,0	3,5	SIV > MFN EP
December	0,0	3,5	SIV > MFN EP

Source: European Commission, TARIC and authors' calculations

It appears that the only periods in 2004 when the agreed (reduced) entry price really made a difference in favour of Morocco were March and May. In the rest of the year, either Moroccan prices were above the entry price (June, August to December), or the entry price system penalised both MFN and Morocco's exports (January, February, April and July).

4. Trade policy scenarios

The preliminary version of the F&V trade model is applied to study the trade impacts of several scenarios of trade liberalisation in the EU fresh tomato market. These scenarios are the following:

- Enlarging Moroccan tomato TRQs (“*Enlarged TRQs*”)
- Reducing or Eliminating Agreed Entry Prices (“*Agreed Entry prices*”)
- Reducing or Eliminating MFN Entry Prices (“*MFN Entry prices*”)
- Converting entry prices into Equivalent Tariffs and reducing them by 50% (“*Tariffication A*”)
- Applying an uniform tariff across the year (“*Tariffication B*”)
- Preference erosion

1. *Enlarging Moroccan tomato TRQs (Enlarged TRQs)*

We will assess the impact of increasing the TRQs by 50%. In the counterfactual scenario all new TRQ are not binding except for May. In those months, market equilibrium for most months (excepting for May) will not be constrained by the existence of a quota. Because the new TRQ is still binding in May, the t_j^o will keep being the price wedge 52.1% (Table 2). However, the size of the quota rent will increase with the TRQ enlargement. We still assume in the preliminary model that quota rents are captured by the importers.

2. *Reducing or Eliminating Agreed Entry Prices (“Agreed Entry prices”)*

We assume in this scenario that the entry price agreed with Morocco within the Association Agreement is phased out. This means that the additional tariff triggered by the entry price system for Morocco is phased out. A significant reduction of tariffs would take place, only the *ad valorem* tariffs remaining.

3. *Reducing or Eliminating MFN Entry Prices (“MFN Entry prices”)*

If entry prices are phased out, this has an impact not only on Moroccan as well as MFN imports. Only *ad valorem* tariffs on tomato from Morocco would remain.

4. *Converting entry prices into Equivalent Tariffs and reducing them by 50% (“Tariffication A”)*

This scenario would be the result of taking the initial tariff equivalents and reducing them by 50%. Because it is probable that a specific tariff component will be maintained, the *ad valorem* equivalents may be different between the MFN suppliers and Morocco.

5. *Applying an uniform tariff across the year (“Tariffication B”)*

The weighted yearly average of the MFN tariff is 19.22%. It is assumed that all previous tariffs on MFN products are replaced by this tariff for all months of the year. A preference on imports from Morocco is assumed to be kept by decreasing in-quota the Moroccan tariff to nil level and keeping the out-of-quota tariff to a 40% of the MFN level.

6. *Preference erosion*

There are many possible scenarios leading to a tariff reduction on MFN imports while keeping protection on Moroccan imports. In this exercise, we take the scenario number 4 and assume that tariff reduction only applies to MFN suppliers.

5. Simulations’ results

Each one of the defined scenarios is assessed through running the F&V model. This consists of the equation system specified in Section 2. Equations are written in GAMS code. The preliminary simulations have been run assuming that the

- elasticity of substitution σ is the elasticity of substitution = 5;
- composite demand for imports’ elasticity $\eta = 1$;
- export supply elasticity for intra-EU good $\mu_1 = 2$;
- export supply elasticity for each origin $\mu_j = 2$;

The results displayed below have to be considered as “exercise simulations”. The value chosen for the elasticity of substitution is quite representative of a market where products are quite homogeneous (low product differentiation), so it is likely that the substitution effects are overestimated. In further developments of the F&V trade model, more realistic values for demand and supply elasticities will be included, drawing on the

available econometric literature. Sensitivity analysis can be easily carried out by changing the parameters in the GAMS file written for the model.

Simulations results for EU tomato imports are presented as percentage changes and absolute values with respect to benchmark sales, which are presented in the Table 3 below. Border and internal prices percentage changes corresponding to each source are computed.

Table 3. EU tomato imports (tons)

	Intra EU25	ROW	Morocco
2004.1	198280,6	6954,3	33388,9
2004.2	191838	5970	26762,7
2004.3	193730,8	7103,9	33571,8
2004.4	187170,5	3943,4	15874,6
2004.5	199144,5	1870,5	7957,9
2004.6	188184,5	3036,7	2484,3
2004.7	187460,4	1289,9	51,4
2004.8	191961,1	375,4	0
2004.9	173361,9	3424,8	0
2004.10	141407,3	4488,7	3998,1
2004.11	147740,4	4210,8	27272,9
2004.12	182621,6	10375,1	39830,3

Source: COMEXT and authors' calculations

The summary Table 4 shows that impacts of trade liberalisation are different depending on the scenario chosen. The removal of entry prices and the tariffication scenarios have relatively larger trade effects. Every scenario including the removal of border measures largely benefits imports from Morocco, except for the preference erosion scenario. This suggests that for this country, multilateral trade liberalisation is as important as bilateral trade liberalisation concerning the EU fresh tomato market. A TRQ enlargement would have less dramatic impact on Moroccan sales as these seem constrained by the entry price system. Preference erosion does not appear a big issue for Moroccan exporters.

Table 4 Impacts of trade liberalisation on fresh tomato market (2004)

Summary (yearly data: 2004)

Scenario	Percentage (%)			Quantities (tonnes)		
	EU	MO	ROW	EU	MO	ROW
Enlarged TRQ	-0,43	10,86	-1,56	-9361	20757	-829
Agreed Entry Price	-5,70	174,98	-14,33	-124497	334543	-7600
MFN Entry Price	-5,86	171,80	11,14	-127979	328477	5911
Tariffication A	-2,45	55,92	22,05	-53432	106914	11698
Tariffication B	-5,01	151,36	-11,52	-109339	289398	-6113
Preference Erosion	-0,31	-0,97	30,80	-6855	-1862	16339

Fresh tomato could well be considered a sensitive good for EU producers as they would favour an enlargement of TRQs instead of bilateral and multilateral trade liberalisations. The removal of the entry price system will have a relatively large effect, which involves the reduction of EU sales by more than 5%. The adoption of the uniform tariff would have lesser negative impact on EU sales, as the protection is rebalanced across the year. As for ROW's exporters, they would loss with the specific phasing out of the Moroccan entry price and with the adoption of a uniform tariff. Export gains for ROW would result of the across-the board tariff reduction (Tariffication A), of a unilateral decrease in MFN effective protection and of the removal of the MFN entry price.

Monthly effects are quite variable depending on the studied scenario. Most of the trade impacts of the entry price and tariff liberalisations would concentrate on the period January-March (when the Spanish production is larger), and in April (when the Dutch production emerges in the fresh tomato market). The TRQ enlargement would have only marginal effects except for March, November and December. The phasing out of MFN entry prices benefits both MFN and Moroccan suppliers, except for February, March and May, when the ROW's exports decrease because of the removal of a barrier that also constrains the relatively competitive Moroccan exports. The tariffication A and the further tariff reduction would benefit ROW exports during all the year. A uniform tariff would instead hamper both ROW and Morocco's exports in the last part of the year, because this would imply larger tariffs for the period between August to December.

Percentage price changes with respect to the benchmark scenario are dramatic in the scenarios of multilateral and bilateral liberalisation of entry prices and tariffs, in particular, for the first four months of the year. EU internal prices could decrease by almost 20% in the scenario of MFN entry price elimination (January), and would also imply a two-digit reduction in February and April. In this last month, trade liberalisation appears especially important for Moroccan exporters, who could see their export price increased by 20% in the scenario of "Agreed entry price" elimination. Moroccan exporters are less sensitive in the scenario of preference erosion and only would increase their price marginally in the scenario of enlarged TRQs, except for March.

6. Conclusions and further developments

We have undertaken the building up of a partial equilibrium model that would be of help to assess the impact of trade liberalisation scenarios related to Mediterranean product, in particular F&V. Recognising that the simulation tool still has some way until it becomes fully operative, the F&V trade model is already able to provide with a framework, ready to use, to assess EU trade agreements that affect selected F&V. The F&V model has been applied to fresh tomato market, in the preliminary simulations presented in this document, and it can be easily extended to other horticultural products which appear sensitive for the EU. The model's value added lies in the detailed specification of policy instruments and in the monthly differentiation of trade impacts, which vary seasonally in this kind of goods.

The first simulations have been applied to the fresh tomato market and have given preliminary information on the impact of selected scenarios of trade liberalisation. As regards to EU producers, bilateral trade liberalisation with extension of TRQs would be the least dramatic scenario. By contrast, the phasing out of the entry price system would have serious consequences on EU producers. The model has also given detailed information on Morocco's interests in the negotiation, although it could easily include a larger number of suppliers. Morocco appears to be interested in multilateral liberalisation as well as in bilateral liberalisation. In fact, multilateral liberalisation will not cause a great deal of preference erosion against Moroccan exporters, unless tariff reductions only affect MFN suppliers.

In the worst case for EU producers (entry price elimination), EU supplies would decrease by 20% in some periods of the year, although impact would be lower in the second half of the year, when current protection is smaller. Price decreases in the sensitive months (first quarter could reach 10%.

Further developments of the model have to be addressed to improve the database, but in particular, the accuracy of the parameters used, such as the CES and the import demand and supply elasticities. The model has to get some degree of dynamics, as consumer and producer decisions in one month could affect decisions in other periods of the year.

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