

Globalisation and Vertical Specialisation in the Australian Passenger Motor Vehicle Industry

I. Introduction

The globalisation of the world economy, brought about by removal of trade and investment barriers, and rapid development in transport and communication networks, has significantly increased international trade in components and parts. As costs of connecting various geographic markets fall, it has become increasingly attractive to host fragmented production blocks involving sequential, vertical trading chains in various locations, with each country specialising in particular stages of a good's production process. Differences in factor prices and factor productivities between countries, together with falling costs of service links, have made it increasingly attractive to move unskilled labour-intensive fragments to countries with an abundant supply of such labour, and capital-intensive fragments to capital abundant nations (Jones and Kierzkowski, 2001). This phenomenon has been tagged 'intra-product specialisation' (Arndt, 1997 and 1998), 'vertical specialisation' (Hummels et. al, 2001 and Yi, 2003), 'slicing the value chain' (Krugman, 1995), 'international product sharing' (Ng and Yeats, 2001 and 2003, Yeats, 2001 and Athukorala and Yamahita, 2006) and 'outsourcing' (Grossman and Helpman, 2005).

The disintegration of the production process, which initially began in apparel and electronics goods, now covers a wide range of manufacturing industries, from automotive, office equipment, power and machine tools, cameras, watches and pharmaceuticals. Nowadays,

consumers even prefer to design their own computers and have them delivered in a matter of days (for example, Dell computers). This phenomenon has now crossed the manufacturing boundary and spread into services such as software design, banking, telecommunications, hotel and airlines bookings etc.

While this phenomenon is not new in industrial economics literature, what is new is its implications for trade flow analysis, income distribution and welfare (Arndt and Kierzkowski, 2001, Deardroff, 2001, Yeats, 2001 and Athukorala and Menon, 2010). Cross border dispersions of intermediate inputs for final assembly/production have been an integral part of the world economy in recent decades.¹ As the share of imported intermediate inputs in production rises the domestic value added share of exports naturally falls. However, the benefit of this phenomenon is that it promotes specialisation based on cost competitiveness and avoids the need to complete all aspects of production process in one location. Cost competitiveness and economies of scale achieved through global production sharing enable product innovation and results in welfare gains (Arndt and Kierzkowski, 2001). Deardroff (2001) convincingly demonstrated that global production sharing lowers adjustment costs by allowing workers to reemploy in other stages in the same sector, while Dean, Fung and Wang (2011) argue intra-product trade simulates trade between developed countries and enlarges gains from trade by allocating the production of various stages of a final product to the most efficient countries.²

¹ In this study we use terms such as intermediate inputs and parts and components (PC) synonymously.

² Markusen (2005), however, notes that all factors of production may not benefit.

Despite these unique features of international production fragmentation and its rising importance globally, to the best of our knowledge, there has not been any study that examines the nature and extent of trade in intermediate inputs in Australian manufacturing, which has experienced a significant structural change over the years.³ Instead, available studies largely focus on the analysis of trade flows in final goods and intra-industry trade (IIT) patterns.⁴ While the analysis of trade flows in final goods and intra-industry trade patterns might be useful in their own right, particularly in pointing out emerging trends in international trade, they obviously fail to capture the dynamism brought about by fragmented-based trade. Also, a major problem with the analysis of trade in final goods is that they are based on the classical notion that countries trade goods that are produced from start to finish in a single location. As fragmented-based trade is playing an increasingly important role in global trade, lumping together trade in parts and components and related-final products can produce misleading policy inference as they are unlikely to follow the same patterns (Athukorala and Menon, 2010). Also, when cross-border trade in parts and components is rising, trade data are double-counted because the splitting of the production process leads to products crossing borders many more times than in ordinary trade, resulting in a rapid but misleading growth in trade figures (Yi, 2003, Athukorala and Yamashita, 2006 and Athukorala and Menon, 2010).

This paper examines the extent of international production fragmentation in the Australian passenger motor vehicle industry. There are a number of reasons why the Australian passenger motor vehicle industry has been chosen. First, there has been a high degree of international production sharing in both the Australian and global automotive industries.

³ For example, the share of elaborately manufactured goods in Australia's exports have significantly increased (see Productivity Commission, 1996).

⁴ See, for example, Menon (1994), Menon and Dixon (1996), Menon, Greenaway and Minler (1999), Sharma (2000), Sharma and Gunawardana (2012) and literature cited therein.

Second, the Australian automotive industry has gone through significant restructuring and rationalisation following the liberalisation of the Australian economy during the mid 1970s.⁵ Third, among Australian manufacturing industries the automotive industry has the highest research and development expenditure (about 25% of total manufacturing research and development expenditure) (see ABS, 2009). Despite this the industry remains very fragile. The rest of the paper is organised as follows: Section II discusses trends in the trade of motor vehicles and components and parts; Section III presents evidence of vertical specialisation in the APMV industry; and Section IV contains the conclusions and some policy remarks.

II. An Overview of Trade in Motor Vehicles, and Components and Parts in the Australian Automotive Industry

The history of the Australian automotive industry (AAI) dates back to 1897 when the first Australian built car was launched in the market behind highly protective trade barriers. However, by the mid 1970s it was increasingly obvious that the industry was not competitive. This triggered a wide range of reforms, although the effective rate of protection to the Australian passenger motor vehicle industry (APMV) remained very high up until the mid 1980s (about 140%). It was only after the mid 1980s that the effective rate of protection (ERP) began to decline, reaching 15% by 2008 (Productivity Commission, 2002 and 2008). A fall in protection increased competitive pressure, leading to significant fluctuations in exports and imports of PMVs. The export-orientation ratio⁶, which was as high as 0.80 in the

⁵ For example, see the Productivity Commission (2009), Dixon et al. (2004), Lionel and Sharma (2011), and Clark et. al (1998).

⁶ Export-orientation or export intensity is defined as the export to output ratio, while import penetration is defined as the ratio of total automotive imports to the total automotive market in Australia (in 2007-08 prices).

mid 1960s, became almost nil by the mid 1980s, while the import penetration ratio fell from 0.90 to about 0.10 during the same period (Figure 1). Between the mid 1970s and mid 1980s, both export-orientation and import penetration were at their lowest levels, which appears to be largely due to the effects of oil shocks. However, since the early 1990s both export-orientation and import penetration have shown rising trends, although the growth in the import penetration ratio has been far greater than the growth in export-orientation. Some improvement in export-orientation since the early 1990s appears to be mainly due to the abolition of a mandatory local content scheme on locally produced PMVs and a reduction of duty on imported components (Figure 1). As Athukorala (2011) correctly argues, while tariff protection and content protection requirements usually lead to more components being produced domestically, they tend to retard exports not only because of the incentive bias against exports, but also because domestic market oriented production usually does not achieve the quality standards and cost competitiveness required for export success.

Figure 1 presents trends in export-orientation and import penetration in the Australian passenger motor vehicle industry (PMV) from 1962 to 2008.

Figure 1 here

Table 1 presents trends in parts and components (PC) trade as well as production and employment in the Australian PMV industry. The average annual growth in PC exports, which was about 10% per annum in the decade to 2000, fell to about -2% per annum by the end of 2010. This declining trend in component exports from Australia is largely a reflection of increased competition in PC trade in international markets, especially from Thailand and China. The decline in component exports from Australia coincides with the departure of some

of the parts and components producers from Australia to China, Thailand and Vietnam to take advantage of cheaper production costs (Lionel, 2011). Imports of parts and components to Australia also declined in the decade to 2010. The average annual growth in component imports fell from 8% per annum during 1990-2000 to just over 1% per annum by 2010. The decline in imports of PC during this period coincides with a fall in domestic production of motor vehicles largely due to intense competition from fuel efficient smaller cars manufactured in newly industrialised economies of Asia. Domestic production of motor vehicles fell dramatically from 5% in the decade to 2000 to about -1% per annum by the end of the next decade (Table 1). As Athukorala (2011) has documented, following the formation of Australia-Thailand Free Trade Agreements, imports of PMVs from Thailand have significantly increased in recent years. Increased import competition has resulted in a fall in employment in the Australian motor vehicle industry from 26,556 in 1990 to 16,184 by 2010.

Table 1 here

III Vertical Specialisation: Measurement Issues and Evidence for the Australian Motor Vehicle Industry

(a) Measurement and Data

In estimating vertical specialisation we closely follow the methodology developed by Hummels et al. (2001) (see Appendix I).⁷ For each i^{th} industry, vertical specialisation can be calculated as follows:

⁷ Note that Hummels et al. (2001) use input-output tables to measure the growth in vertical specialisation in world trade at both industry and country level.

$$VS_i = (MI_i / D_i + E_i) * E_i \quad (\text{Eq 1})$$

This is equivalent to $(E_i / D_i + E_i) * MI_i$

Where, MI_i = imported intermediate inputs in industry i

D_i = Domestic consumption of final product of industry i

E_i = Exports of industry i

When the proportion of exports to total sales ($E_i / D_i + E_i$) is multiplied by the value of imported intermediate inputs (MI_i), the result is the dollar value of imported inputs contained in i^{th} industry's exports (VS). To obtain the share of imported inputs contained in each dollar of exports for i^{th} industry, we divide vertical specialisation by the dollar value of exports (E) (see, Dean et. al, 2007).

Data for this study is obtained from Key Automotive Statistics compiled by the Australian Automotive Industry (AAI), which provides data on exports and imports of intermediate inputs as well as passenger motor vehicles. Unfortunately, it does not report sources of intermediate inputs imports or destination of intermediate input exports, which prevents us from analysing regional or country specific contributions to vertical specialisation in the Australian motor vehicle industry.

(b) Evidence of Vertical Specialisation

The estimate of vertical specialisation is presented in Figure 2, which shows a clear evidence of increasing vertical specialisation in the Australian passenger motor vehicle industry (i.e. the value added share of imported inputs is growing). The ratio of imported inputs to total production is high and rising. It rose from about 50% in 1990 to about 90% by 2010, although the data set does not allow identification of the sources of these inputs.⁸ As shown in Figure 2, imported inputs made up about 90 cents of every dollar's worth of the industry's exports, suggesting that the actual contribution of the Australian motor vehicle industry to domestic value added is far less than expected.

Rising vertical specialisation (i.e. import dependence) is not surprising given that Australian motor vehicle manufacturers face intense competition from emerging Asian economies, namely Thailand, Korea and Malaysia. As competition in both domestic and export markets increases, Australian PMV producers are increasingly outsourcing the supply of intermediate inputs (including parts and components). For instance, tyres used in Australian made cars are manufactured in the Philippines, computer chips are made in Malaysia, and fuel injection systems are produced in Japan, while airbags are manufactured in Thailand. While increasing reliance on imported intermediate inputs from different sources may have made the industry more competitive in the short-run, rising import intensity and fluctuations in the export-orientation ratio tend to suggest this may not be the case. In fact, in a study of total factor productivity in the Australian motor vehicle industry for the period 1965-2008, Bopage (2011) found evidence of declining productivity in the Australian automotive industry.

⁸ We are also unable to determine whether these inputs have come in the form of inter-or intra-firm trade. However, given the dominance of multinational companies in the Australian motor vehicle industry, we presume most of the imported intermediate inputs are intra-firm trade (Bopage, 2010).

Figures 2 and 3 about here

So, what are the welfare implications of this phenomenon? Ideally, to answer these questions one needs to undertake an economy wide general equilibrium analysis, which is not only data intensive, but also time consuming. However, it is possible to draw some general inferences based on the industry's performance in terms of exports, employment and motor vehicle affordability index. There is no way to trace how losses in production, exports and employment in the PMV industry have been compensated elsewhere in the economy. Rising vertical specialisation, together with lacklustre growth performance of both domestic production and exports of motor vehicles especially in the decade to 2010, tend to suggest that flow-on effects of the industry on the Australian economy is much less than expected, although improvements in the motor vehicle affordability index suggest some welfare gains brought about by liberalisation and international production fragmentation (Figure 3).⁹

Affordability

V. Conclusion

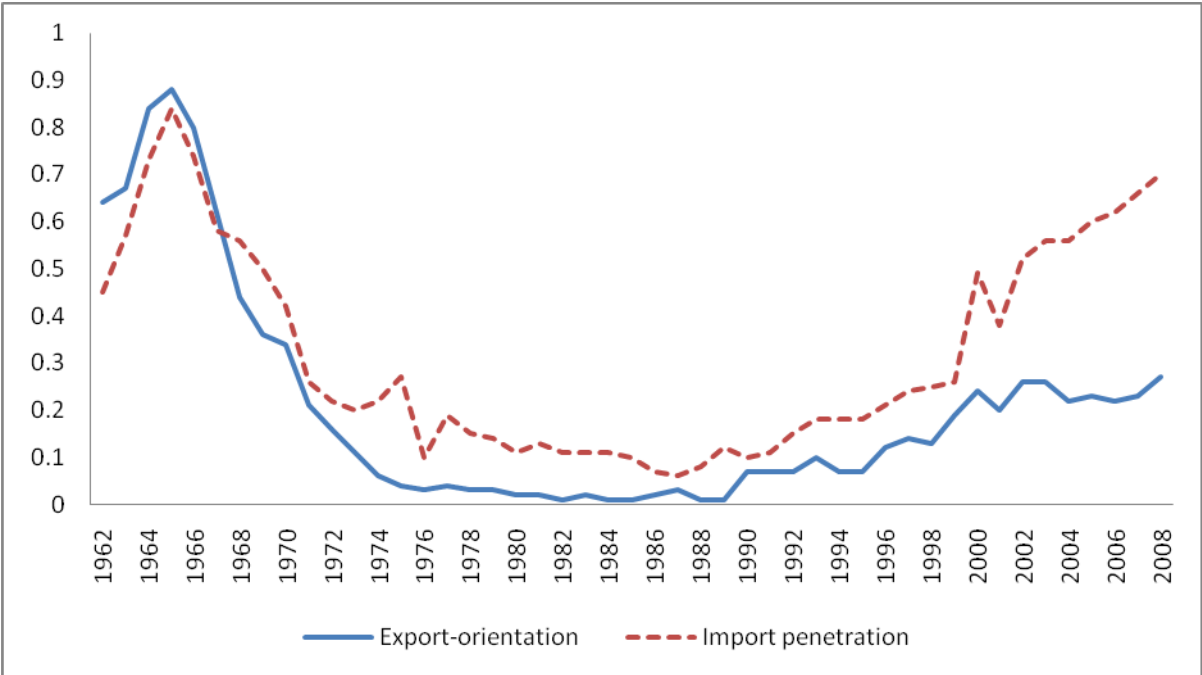
This paper contributes to the literature on international production fragmentation by documenting the evidence from the Australian passenger motor vehicle industry. Our analysis shows that vertical specialisation in the Australian motor vehicles is high and rising, suggesting the industry is well-integrated in the global production network. The ratio of

⁹ The affordability index of motor vehicles is calculated by dividing average weekly earnings by CPI for motor vehicles. A rise in the index suggests an improvement in affordability over the years. However, the affordability index is largely influenced by greater access to cheaper imported cars into the Australian market.

imported inputs to total domestic production rose from about 50% in 1990 to about 90% by 2010, indicating that foreign value added in every dollar's worth of the industry's exports is about 90 cents. Rising vertical specialisation, together with lacklustre growth performance of both domestic production and exports of motor vehicles, especially in the decade to 2010, tend to suggest that flow-on effects of the industry on the Australian economy is much less than expected, although improvements in the motor vehicle affordability index might suggest some welfare gains. Growing vertical specialisation raises important policy questions for the ongoing industry assistance (including research and development support) and points out the need for the review of the industry assistance and research and development programs.

Results from this study are preliminary and they must be interpreted with caution. Given the data limitations we have not been able to disaggregate the nature and extent of vertical specialisation (i.e. types of intermediate input imports and the origin of the imports by region or country). Also, we have not examined the determinants of vertical specialisation in the Australian motor vehicle industry due to short period covered by this study. These can be addressed in future research as better data become available.

Figure 1: Export-orientation and import penetration in the Australian motor vehicle industry, 1962-2008



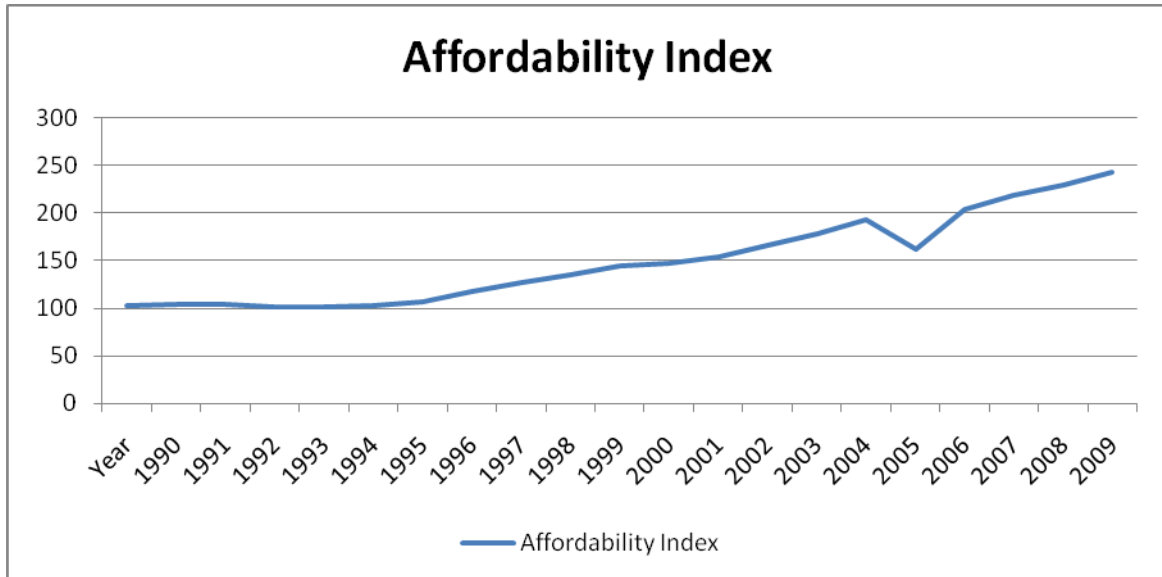
Source: Calculated from data from the Australian Automotive Intelligence Yearbook (various issues).

Figure 2: Vertical Specialisation % in the APMV: 1990-2010



Source: Author's estimate based on Key Automotive Statistics (various issues).

Figure 3: Affordability index: 1990-2009, Base year 1989-90



Source: Key Automotive Statistics (various issues).

Note: The Affordability Index is based on methodology developed by the Automotive Industry Authority and the Australian Automotive Intelligence Report.

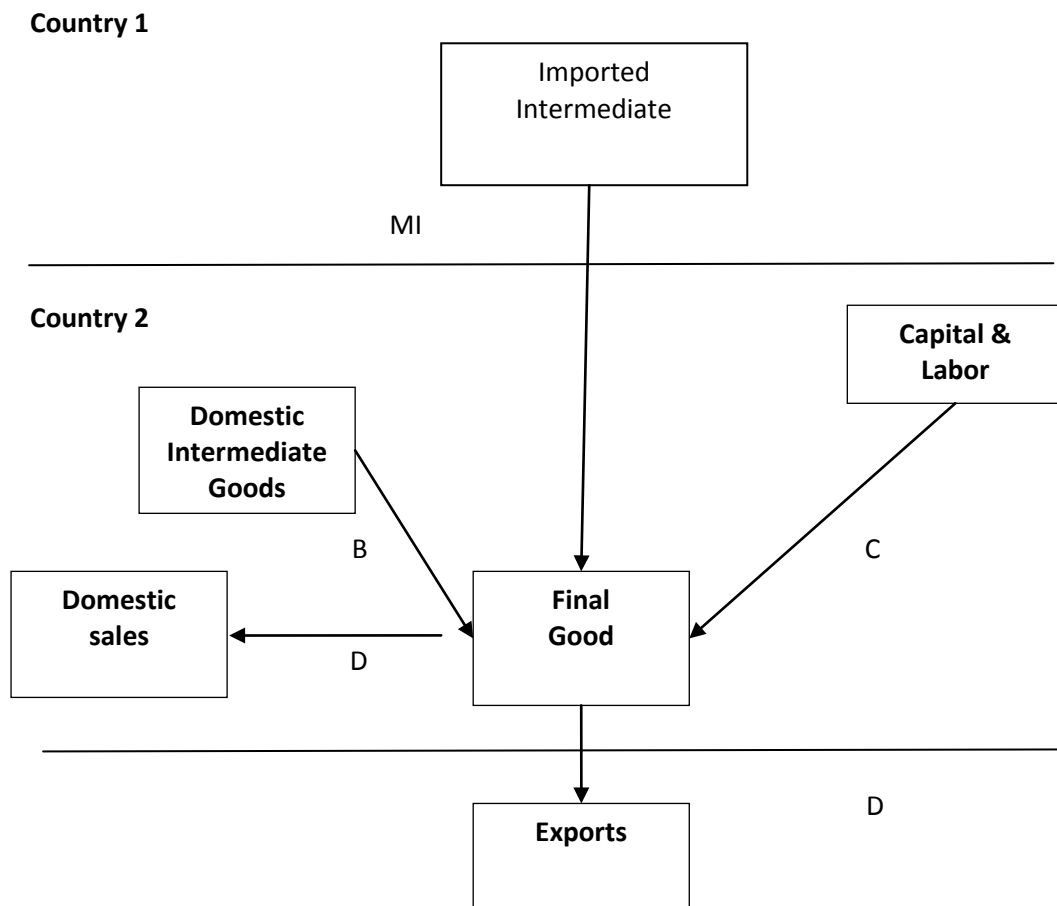
Table 1: Exports and Imports of Parts and Components (PC), PMVs, domestic production and Employment in the Australian Automotive Industry: 1990-2010 (Growth rates in %)

Year	Exports of PC (M\$)	Imports of PC (M\$)	Exports of PMVs (M\$)	Imports of PMVs (M\$)	Domestic Production of PMVs (M\$)	Employment in PMVs ('000)	PC exports % of PMV trade	PC imports % of PMV trade
1990	618	2,258	355	1,278	4437	34,774	37.84	138.27
1991	736	1,988	391	1,332	4344	30,228	42.72	115.38
1992	798	2,414	409	1,892	4544	26,402	34.68	104.91
1993	889	3,069	562	2,179	6244	22,896	32.43	111.97
1994	943	3,527	464	2,620	7020	22,559	30.58	114.36
1995	1,112	3,611	485	2,925	7100	22,477	32.61	105.89
1996	1,154	3,532	837	2,955	7110	20,872	30.43	93.14
1997	1,383	3,621	1,077	3,553	7230	20,540	29.87	78.21
1998	1,222	4,422	1,133	4,018	8180	22,370	23.72	85.85
1999	1,520	5,056	1,760	4,128	8180	21,390	25.81	85.86
2000	1,820	5,700	2,420	11,170	7740	20,378	13.39	41.94
2001	1,700	5,940	3,260	11,610	7970	19,975	11.43	39.95
2002	1,770	5,610	3,080	13,200	7990	20,914	10.87	34.46
2003	1,770	5,680	2,980	14,520	8480	23,119	10.11	32.46
2004	1,680	5,720	3,030	15,720	8890	22,485	8.96	30.51
2005	1,710	5,870	3,470	17,460	8410	20,908	8.17	28.05
2006	1,820	5,970	3,060	18,360	7840	18,390	8.50	27.87
2007	1,870	6,400	3,250	20,910	7740	17,751	7.74	26.49
2008	1,760	6,790	4,030	22,750	7490	14,728	6.57	25.35
2009	1,280	5,750	1,840	16,880	6650	12,294	6.84	30.72
2010	1,510	6,630	2,090	22,760	7102	13,035	6.08	26.68
Average Growth* 1990-2000	9.82	8.42	17.45	19.71	5.06	-4.86	30.37	97.80
Average Growth* 2000-2010	-1.69	1.37	-1.33	6.47	-0.78	-4.06	27.97	88.86

Source: Key Automotive Statistics (various issues). * = average for the period.

Note that PC import figures also include components imported for replacement and repairing purposes. There is no way one can identify how much of imported parts and components are used for replacement and repairing purposes.

Appendix I: Vertical Specialisation



Source: Hummels et al. (1999)

Appendix II: Key Indicators: Australian Automotive Industry

(value in million A\$ unless otherwise stated): 1990-95

Year	Value of PMV production	Value of PMV exports	Value of PMV imports	Imports as % of total consumption	PC exports % of PMV trade	PC imports % of PMV trade	Employment ('000)
1990-95	4,437	444	3,871	49.0	30	95	26,556
1995-2000	7,100	1,285	4,792	45.1	26	82	21,338
2000-05	8,180	2,755	11,725	68.3	10	35	21,377
2005-10	8,410	2,957	19,853	78.3	7	28	16,184

Source: Calculated by the author from Key Automotive Statistics (various issues)

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