Research On the Influencing Factors of Pulp Import Trade in China

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Abstract. Paper industry is an important basic industry of the national economy, is recognized as "never exhausted" industry. In the 21st century, with the development of social economy, China has become the world's paper products consumer power. Since 2003, China's pulp imports ranked first in the world, and the gradually expanding trade deficit will not only have an impact on China's pulp industry, but also is not conducive to the sustainable development of import trade. Based on the production and consumption gap in China's pulp market, this paper analyzes the demand, scale and structure of pulp import trade, and then empirically analyzes the influencing factors of China's pulp import trade, and finally puts forward the suggestions for safeguarding the safety and interests of China's pulp import trade according to the research results.

Keywords: Pulp; import trade; influencing factors.

1. Introduction

Paper industry is an important basic raw material industry of the national economy. Paper products are widely used in many fields such as education, packaging and printing, and play an indispensable role. Over the past few decades, China's papermaking and paper consumption have developed rapidly, gradually becoming one of the world's largest producers and consumers of paper products. The rapid development of the paper industry has also led to the sustained development of related industries, such as pulping and paper processing, creating a large number of employment opportunities and also promoting economic and social development.

Pulp as the paper industry's most important raw material, its supply directly affects the production of downstream paper products, while the development of the downstream paper industry also directly determines the demand for pulp industry. However, the lack of domestic pulp production capacity has led to the growing importance of imported pulp. According to customs statistics, the total import of pulp was 24.09 million tons,the gap between supply and demand of pulp reached 25% of the total consumption. With the continuous expansion of China's pulp import scale, China's pulp import trade has been affected by multiple factors such as supply and demand, price and relevant policies and regulations from domestic and foreign markets. In this context, the huge import scale is an important matter related to the development of China's paper industry and national economic welfare. If China is in a disadvantageous position in the international trade of pulp for a long time, it will cause great losses to the economic development in the current and future.

In recent years, research on the development of China's paper industry is mainly focused on the optimization of production processes and quality in the field of industrial economy, pulp as a small class of products in the HS4701-4706 catalog compared to the major categories of forest products trade research is relatively less. The research content of China's pulp import trade mainly focuses on import characteristics and import risk assessment. Cheng and Liu (2006) analyzed the import trend of wood, woodenboard, wood pulp, paperboard and paper products in China from 1997 to 2003 and pointed out that the import volume of wood and wood pulp would continue to grow. Xiong (2017) considered the changes in the import volume and unit price of pulp, and pointed out that because the growth rate of import volume was higher than the decline rate of the unit price of pulp import, China's total import trade of pulp would rise. Zhuochuang Paper (2020) pointed out that in China's pulp

imports from 2016 to 2019, although the import volume of wood pulp increased, the proportion decreased, while the import volume of other pulp, mainly waste pulp, showed a trend of rapid growth. In terms of research methods, quantitative research is lessly adopted. Based on the summary of the status quo of pulp import trade in the past two decades, this paper sorts out the influencing factors that may affect the volume change of pulp import and conducts empirical analysis, in order to provide scientific support for the formulation of relevant policies for China's pulp import and the guidance of the domestic pulp market.

2. Status of import trade

2.1. Demand for imports

Under the limitation that China's domestic pulp output tends to be stable, and it is difficult to achieve leapfrog improvement in the short term, the gradually increasing domestic pulp consumption is the direct factor stimulating pulp import.

2.1.1 Analysis of domestic pulp production

Taking the production and consumption from 2010 to 2019 as an example, pulp production surged 5.53% in 2011, but the total national pulp production remained basically unchanged from 2011 to 2019. Limited by China's forest resource endowment and stricter environmental protection policies, China's pulp production tends to be stable at the level of 70 million tons.

Domestic paper pulp is mainly divided into three parts: wood pulp, non-wood pulp and wastepaper pulp. Wood pulp is the most high-quality paper pulp, grass pulp in non-wood pulp is seriously polluted, and wastepaper pulp is mainly produced by recycling wastepaper pulp. Since 2010, benefiting from the guidance of the government's industrial policy, the output of wood pulp with less pollution has increased year by year, from 7.16 million tons in 2010 to 12.68 million tons in 2019, with a growth rate of 77%, accounting for 17.6% of the total pulp production from 9.80%, and will continue to increase in the future. At the same stage, the output of non-wood pulp decreased year by year, from 12.97 million tons to 5.88 million tons, among which the output of grass pulp with the most serious pollution decreased from 7.19 million tons to 2.22 million tons; In addition, domestic waste pulp production increased first and then decreased in ten years. Affected by the environmental protection policy of "waste ban", the output of waste pulp declined rapidly in 2018 and 2019. It is expected that from 2021, there will be no imported wastepaper and other solid wastes in domestic pulp.

From 2010 to 2019, the change in the structure of domestic pulp during this decade also reflects the effect of industrial transformation and upgrading and environmental protection of China's paper industry. However, as the consumption of pulp in China increases year by year, the production of domestic pulp in China is stable or even slightly declining, which makes the gap between supply and demand in China's pulp market continue to expand.

Table. 1 Pulp production Unit: ten thousand tons

Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gross amount	7318	7723	7867	7651	7906	7984	7925	7949	7201	7207
Wood pulp	716	823	810	882	962	966	1005	1050	1147	1268
Waste pulp	5305	5660	5953	5940	6189	6338	6329	6302	5444	5351
No-wood pulp	1297	1240	1074	829	755	680	591	597	610	588

Source: *China Paper Yearbook 2020*

2.1.2 Analysis of domestic pulp consumption

In the past ten years, the average annual growth rate of China's pulp consumption is about 3%. Overall, the domestic pulp consumption has been stable in recent years, while the annual imported pulp consumption has been rising year by year.

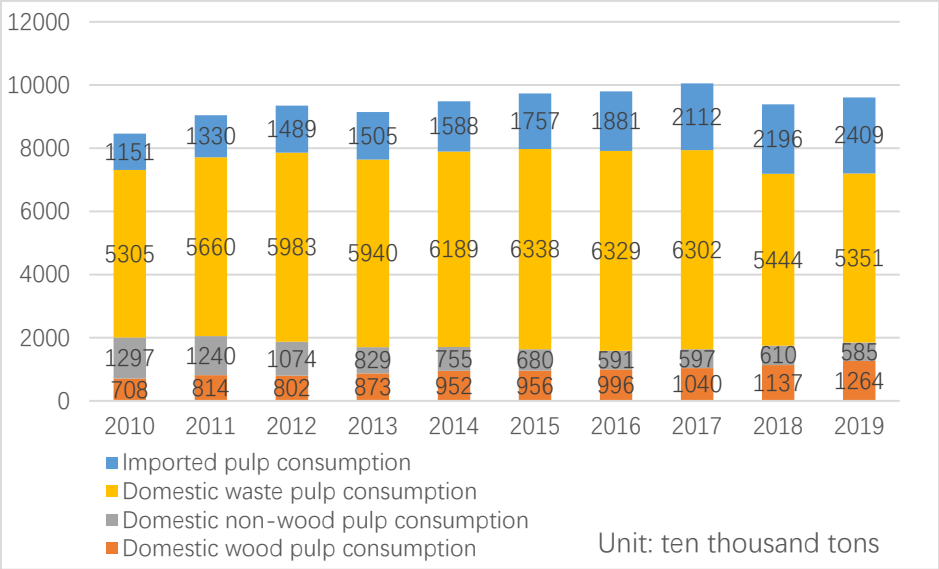

Fig. 1 Pulp consumption

Source: *China Paper Yearbook 2020*

Since 2010, the consumption of wood pulp in China's paper industry has increased year by year, while the consumption of non-wood pulp has decreased year by year. The total consumption of waste pulp has increased first and then decreased. The consumption of domestic waste pulp accounts for nearly 70% of the total consumption of pulp, while imported waste pulp plays a minor auxiliary role.

With the continuous development of China's economy and society, the society's industrial production demand and living demand for paper and paper products are increasing. China's pulp is mainly produced for self-use and is less frequently put into the commodity pulp market for trading. It is expected that after the comprehensive ban on the import of foreign waste paper in 2021, China's waste pulp production will be greatly reduced due to the tightening of the raw material end, resulting in the gap between supply and demand of the overall consumption of pulp may reach more than 30 million tons, which will directly lead to China's serious dependence on pulp import.

2.2. Scale of imports

China's pulp import scale has gone through different stages in the past few decades. In the early 1980s, China began to import pulp on a large scale, mainly to meet the development needs of the country's nascent paper industry. At that time, China's pulp imports were very small, only tens of thousands of tons. At the beginning of the 21st century, China's pulp import scale has reached the level of one million tons, and in 2009 for the first time exceeded the level of 10 million tons (13.67 million tons). From 2010 to 2020, China's import volume of pulp has been maintained at a high level, exceeding 30 million tons for the first time in 2020, and the import value reached 15.698 billion US dollars. Although the growth rate slowed down in the later period, China's total pulp import still increased by 65.21% from 2012 to 2019, with an average annual growth rate of 9.32%, among which the average annual growth rate of wood pulp import was 8.57%. The following Fig.2 reflects the growth of China's pulp import scale in the past 20 years through import volume and import value respectively.

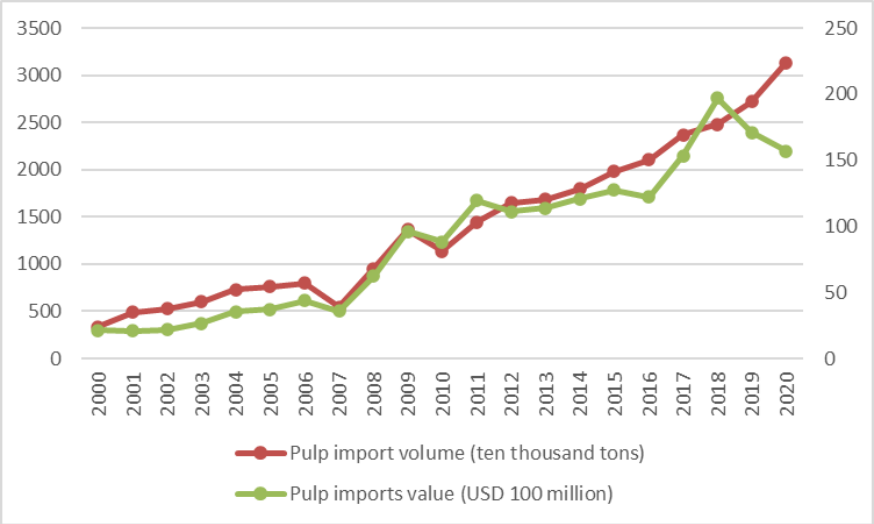

Fig. 2 Trend of China's pulp import scale from 2000 to 2020

Source: UN Comtrade Databae

It can be seen that the growth trend of import volume and import value is basically consistent. Before 2006, the growth rate of China's pulp import volume is relatively slow, and then drops sharply in 2007, which may be because the domestic bleached pulp capacity increased significantly in that year, thus reducing the import from abroad. Since then, the growth rate of imports has accelerated significantly, and the second slight decline in 2009 can be attributed to the lagged effect caused by the economic crisis in 2008. After 2010, the import volume maintained a steady growth, and in 2019, there was a small growth peak. The reverse trend after 2018 May be related to changes in the US dollar exchange rate.

2.3. Structure of imports

2.3.1 Structure of imported commodities

Since more than 90% of the pulp I import is wood pulp, pulp trade actually refers to wood pulp trade. Between 2010 and 2019, wood pulp imports grew steadily at an average annual growth rate of 14.6%, while the import volume of other pulp (mainly waste pulp and dissolved pulp) grew at an astonishing average annual growth rate of 68.5%. In particular, the import volume of other pulp increased by an astonishing 445.6% month-on-month in 2019.

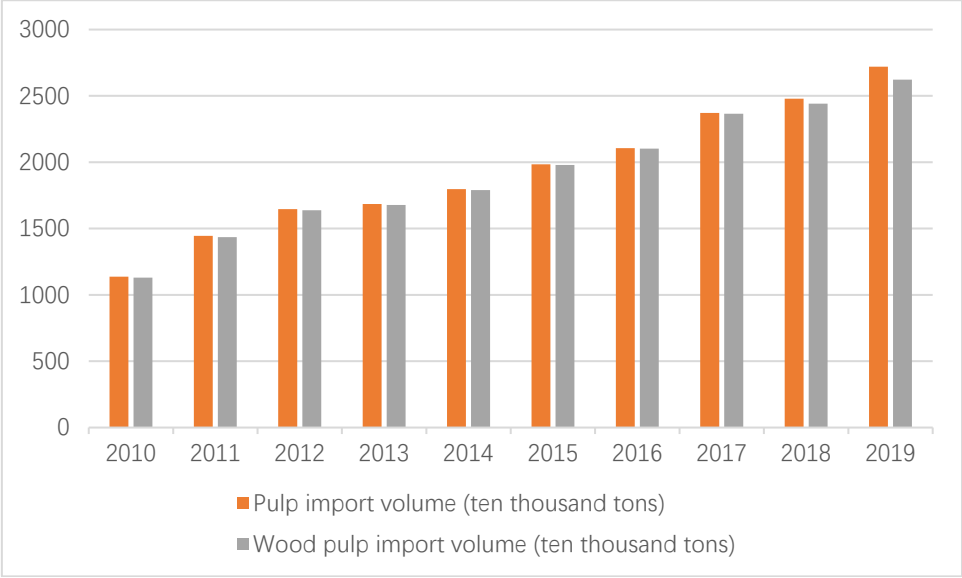

Fig. 3 China's pulp-wood pulp import volume from 2010 to 2019

Source: *China Forestry and Grassland Statistical Yearbook 2020*

In 2019, China's total pulp imports exceeded 27.2 million tons, of which wood pulp accounted for more than 96.35%, and its total imports reached 26.2 million tons. Under the sub-category of wood pulp, caustic soda wood pulp or sulfate wood pulp are the main types of wood pulp imported in China, accounting for 82.12% of the net import of wood pulp in 2019. The second category is chemical wood pulp, dissolved grade wood pulp, imported net weight of 3,063,900 tons, accounting for 11.69%.

Table. 2 Wood pulp imports in 2019

HS code	4701	4702	4703	4704	4705
Type of wood pulp	Mechanical wood pulp	Chemical wood pulp, dissolving grade	Caustic soda wood pulp, sulphate wood pulp	Sulfite wood pulp	Pulp produced by a combination of mechanical and chemical pulping methods
Import volume/kg	8657261	3063860257	21519648676	18549358	1595266912
Proportion /%	0.03	11.69	82.12	0.07	6.09

Source: China Customs Administration

Since 2018, the import volume of waste pulp has been increasing, which is the result of the intensive implementation of the policy of "banning the entry of foreign garbage" since 2018. The upstream raw materials of China's paper industry are mainly pulp and wastepaper. Previously, due to the large demand and the imperfect domestic waste paper recycling system, the domestic waste paper import volume is large. The introduction of the "ban on waste" directly impacted the upstream supply pattern, and the import of waste paper decreased sharply. As a substitute, the import of waste pulp (recycled fiber pulp) reached about 290,000 tons in 2018, an amazing 2371% increase compared with the same period last year. In 2019, it was about 910,000 tons, up 209% from the same period last year, and the import volume of waste pulp will continue to grow in the future.

2.3.2 Structure of the import market

Table. 3 Distribution of pulp importing countries Unit: %

Year	U.S.	Canada	Brazil	Indonesia	Chile	Russia	Japan	U.K.	Finland
1998	21.58	22.94	3.2	23.7	8.7	9.3	——	——	——
2008	27	14	8	7	6.5	6.3	6.2	4.9	3.3
2012	12.9	24.9	15.5	10.6	9.5	6.9	6.8	8.3	7.5
2019	9.44	19.9	30.9	13.6	11.2	6.3	——	——	——

Source: China Forestry Information Network

It can be seen from table 3 that the proportion change of the main source countries of China's pulp imports in the interval spanning 20 years. China's two biggest pulp importers are the United States and Canada, followed by Indonesia, Brazil and Chile. Under the fluctuation of the world pulp market, China's pulp import from the above nine countries also shows the characteristics of different periods.Before 2000, the top three countries accounted for nearly 70% of China's total imports, but less than 50% in 2008; Since 2012, the overall proportion of China's pulp import has shown a trend of dispersion. The quantity of China's pulp import from Brazil, Indonesia and Chile has increased, while the proportion of China's import from Canada and the United States has been declining.

On the macro level, in the 1990s and early 21st century, China's pulp imports were mainly concentrated in North America and European countries, and gradually turned to South America, Asia and Oceania, especially the amount of pulp imported from Brazil, Chile and Uruguay increased significantly. In addition, those developed countries that are relatively deficient in forest resources, such as Japan, Britain and Holland, have participated in China's import trade more and more deeply. However, comprehensive view of China's paper industry pulp import market concentration is still

relatively high. Although China, as a big importer of pulp in the world, has a certain buyer's market, it is still in a passive position in the oligopoly international pulp export market.

3. Analysis on the influencing factors of pulp import trade in China

3.1. Theoretical mechanism of influencing factors

Pulp import trade is affected by many domestic and international factors, which interact with each other and jointly shape the trade pattern of imported pulp.

3.1.1 Domestic supply, demand and policy

China's economic growth promotes the rapid development of various industries, and the consumption and demand for resources are increasing day by day. Wang et al. (2017) believed that with the advent of the Internet + logistics era, the rapid development of the domestic packaging and printing industry has indirectly led to the increase in the import volume of pulp. Jiang, S. and Nie, Y. (2008) showed that due to the expansion of China's papermaking capacity and the growth of paper products export, the demand for paper products was strong. One result of domestic paper replacing imported paper is to increase the demand for wood pulp, the raw material for paper making.

The imbalance between domestic pulp supply and demand is the direct factor affecting the change of pulp import scale. China's pulp supply is limited by China's scarce forest resources. According to data released by the State Forestry Administration, China's forest coverage rate is about 21.63% up to now, and there is still a certain gap with the global average of 31%. Secondly, production capacity is also affected by related technologies and energy prices. In the case of increasingly strict environmental protection policies and rising energy prices, the increase in domestic production costs of pulp will put pressure on the supply side. But at the same time, domestic pulp enterprises are also transforming and upgrading by strengthening R&D and technology introduction, striving to improve product quality and reduce production costs, increase supply, so as to reduce pulp import dependence.

In addition, forestry-related industry policies, trade policies and other "license-like" regulations can also influence the volume of import trade. Wang Q. and Wang Li.(2008) believed that China's accession to WTO in 2001, which reduced tariffs on 249 forest products and gradually removed non-tariff measures, was an important reason for the significant changes in China's wood pulp import before and after WTO entry. Wang Hongzhi (2019) believed that the Notice on *Improving the Policy of Returning Farmland to Forest* issued in 2007 promoted the import of forest products, especially pulp. In 2017, the introduction of the new policy of *"banning the entry of foreign garbage"* has affected the import volume of wastepaper. With the substantial reduction of wastepaper pulping raw materials, the external dependence of imported wood pulp may be further enhanced.

3.1.2 International environment

The supply and demand of the world pulp market directly affects the price, quantity and quality of our country's pulp import. If the world pulp market is oversupplied, the import price is relatively low, the import quantity increases, and the import quality may also decline; Conversely, if supply is tight or market demand is strong, import prices are relatively high, import quantity is reduced, and import quality may improve. In addition, the situation of the world pulp market will also affect the source and way of imported pulp in our country. CAI et al. (2013) believed that the domestic pulp supply was limited, but China's wood pulp import would benefit from the booming development of the international paper industry and the expansion of international pulp production.

Exchange rate changes have a clear impact on trade. The essence of the effect of the exchange rate on the trade balance is through relative prices. Based on the in-depth analysis of the trend chart of RMB exchange rate and the changes of China's pulp import and export from 2006 to 2016, Xu et al. (2017) concluded that RMB exchange rate mainly caused China's pulp trade deficit by affecting pulp import. With the rise of RMB exchange rate, China's pulp import shows a relatively decreasing trend.

3.2. Empirical analysis of influencing factors

3.2.1 Variable selection and model setting

According to the previous analysis, the empirical part will take China's annual pulp import volume (Y) as the explained variable, and select nine quantifiable and available indicators as the explanatory variables, specifically: domestic pulp output and world pulp output are selected from the supply level; From the demand level, per capita GDP and per capita pulp consumption are selected; From the downstream industry demand to choose paper and board domestic output; Choose the import volume of waste paper from the perspective of substitutes; The price factor is reflected by the average price of pulp import; From the perspective of international trade, exchange rate is selected that may affect imports; In addition, considering the toughness of the waste prohibition policy, we include the dummy variable of whether the imports are constrained by the waste prohibition policy, which is equal to 1 if yes.

Table. 4 List of empirical variables

Variables	Meaning	Expected sign
Y	China's pulp import volume (ten thousand tons)	+
X1	China's GDP (2015 constant US dollars)	+
X2	Per capita pulp consumption (kg)	+
X3	Domestic pulp production (10,000 tons)	-
X4	Paper and paperboard domestic production (10,000 tons)	indeterminate
X5	Waste paper import volume (10,000 tons)	-
X6	Pulp import unit price (US dollars per ton)	-
X7	World pulp production (10,000 tons)	indeterminate
X8	Annual average exchange rate (direct quotation method)	-
T	Policy on waste import ban	+

The empirical analysis is based on economic or industrial data from 2000 to 2019, mainly from China Paper Yearbook, China Forestry Statistical Yearbook, UN cometrade website, World Bank database and IMF financial database. The double-log model can greatly reduce the heteroskedasticity and collinearity in the model estimation, so all other variables except the dummy variables are taken as logarithms. Based on Stata17, this paper uses multiple regression method for research. The model is as follows:

$$\ln Y=c+c_1\ln x1+c_2\ln x2+c_3\ln x3+c_4\ln x4+c_5\ln x5+c_6\ln x6+c_7\ln x7+c_8\ln x8+c_9T+\varepsilon \quad (1)$$

3.2.2 Analysis of correlation

Before the formal regression, the correlation test can be used to understand the simple correlation between variables, and the results are shown in Table 5. It can be seen that there are significant simple linear correlations between multiple explanatory variables and the explained variables, and there are also multiple sets of significant linear correlations between explanatory variables, so the multicollinearity of the model is questioned.

Table. 5 Pearson correlation coefficient

	lny	lnx1	lnx2	lnx3	lnx4	lnx5	lnx6	lnx7
lnx1	0.970***	1						
lnx2	0.902***	0.944***	1					
lnx3	0.877***	0.925***	0.998***	1				
lnx4	0.919***	0.958***	0.999***	0.994***	1			
lnx5	0.674***	0.703***	0.880***	0.898***	0.862***	1		
lnx6	0.586***	0.684***	0.755***	0.768***	0.745***	0.599***	1	
lnx7	-0.373	-0.278	-0.237	-0.225	-0.241	-0.242	0.0640	1
lnx8	-0.853***	-0.882***	-0.907***	-0.909***	-0.907***	-0.774***	-0.772***	0.401*

***p<0.01, **p<0.05, *p<0.1.

3.2.3 Stepwise regression

To begin with, a stepwise regression analysis was conducted on nine explanatory variables, including China's pulp import volume, China's GDP, per capita pulp consumption, domestic pulp production, etc., the results of which are presented below (1).

Table. 6 Regression results

	(1)		(2)
VARIABLES	Stepwise regression		
lnx1	/		0.708
			(1.23)
lnx2	/		0.276
			(0.30)
lnx3	-4.569***		
	(-7.89)		
lnx4	5.549***		
	(10.12)		
lnx5	/		0.004
			(0.02)
lnx6	/		-0.749*
			0.004
lnx7	-3.264**		
	(-2.70)		
Lnx8	/		-1.696
			(-1.49)
T	/		0.274
			(1.19)
Constant	29.098**		-6.929
	(2.43)		(-0.38)
Observations	20		20
R-squared	0.973		0.960

t-statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1

From the model results, the t-test of X3, X4 and x7 is very significant, excluding all other factors, which fully shows that the domestic pulp output, the domestic output of paper and board and the world pulp output have a very significant impact on the pulp output of our country; The regression results show that the coefficient of China's pulp output is − 4.569, indicating that when China's pulp output increases by 1%, the pulp import volume will decrease by 4.569%, which is in line with the expectation of economic significance.

Given the domestic demand for pulp has significantly exceeded supply and reached a certain scale, enhancing domestic supply can reduce reliance on imports. However, with the improvement of purchasing power, China's demand for pulp will not only increase in quantity but also undergo a qualitative transformation. A large proportion of the pulp products imported by China from around the world are hardwood pulp with higher environmental technology requirements, and many of the imported paper products belong to high-end categories. Excluding systematic errors in the data, the increase in quality requirements for imported pulp may be a factor contributing to the negative impact of seven times the world pulp production on China's pulp import volume.

Furthermore, the domestic production of paper and paperboard has a significant impact on the import volume, with a 1% level of significance. The model suggests that for every unit increase in domestic paper and paperboard production, there is a need for an increase of 5.5 units in pulp imports. This phenomenon can be attributed to the fact that China is both a major consumer and producer of paper products. The primary purpose of China's pulp imports is for the production of paper and paper products. As a major downstream product, the domestic production of paper and paperboard represents the consumption demand for paper products. With stable shortages in domestic supply, demand can effectively drive the import of raw materials.

Stepwise regression is based on the fundamental idea of reducing multicollinearity. In order to further investigate the impact of China's GDP, per capita pulp consumption, waste paper import volume, average import price of pulp, exchange rate, and other factors on China's pulp imports, an empirical model of the relationship between pulp imports and a comprehensive set of domestic and foreign factors was established after excluding x3, x4, and x7, and then regression analysis was conducted using a time series approach (2).

$$\ln Y=\beta_0+\beta_1 \ln x1+\beta_2 \ln x2+\beta_3 \ln x5+\beta_4 \ln x6+\beta 5 \ln x8+\beta_6 T+\varepsilon_t \quad (2)$$

3.2.4 Stationarity Test

In regression analysis, non-stationary time series often lead to "spurious regression" when traditional econometric methods are used, resulting in inaccurate model inference and estimation. Therefore, it is necessary to conduct a stationarity test on the data series. In this study, we employ unit root tests and find that after second-order differencing, all variables become stationary, forming a set of integrated order one sequences, meeting the prerequisite conditions for cointegration analysis.

Table. 7 ADF test results

	T-value	5% critical value	P-value	Stationarity
Lny(2)	-6.536	-3.000	0.0000	stationary
Lnx1(2)	-4.273	-3.000	0.0005	stationary
Lnx2(2)	-7.245	-3.000	0.0000	stationary
Lnx5(2)	-7.680	-3.000	0.0000	stationary
Lnx6(2)	-4.276	-3.000	0.0005	stationary
Lnx8(2)	-4.398	-3.000	0.0003	stationary

3.2.5 Co-integration test

Cointegration analysis provides a mechanism to explore long-term equilibrium relationships among multiple non-stationary time series. Due to the model's numerous independent variables, this study employs the Johansen method for cointegration testing to determine whether there exist long-term stable relationships among multiple variables. The results reveal that at a 5% significance level,

with a cointegration order of 3, the trace statistic value of 586.974 and the maximum eigenvalue statistic value of 638.3721 both exceed their critical values (see the appendix table), leading to the rejection of the null hypothesis. This suggests the presence of three cointegrating relationships among the variable sequences, and the established cointegrating relationship model exhibits statistical significance and predictive ability. In other words, there exists a long-term stable equilibrium relationship among the variables, allowing for multivariate regression. Refer to Table 6(2) for the regression results.

Table. 8 Johnson test results

		H1:	
Eigenvalues (lambda)	H0: rank<=(r) r	Max-lambda statistics (rank<=(r+1))	Trace statistics (rank<=(p=7))
1	0	.	.
1	1	.	.
1	2	.	.
1	3	586.974	638.3721
0.824336	4	31.30531	51.39812
0.67215	5	20.0736	20.09282
0.001067	6	0.019214	0.019214

3.2.6 Statistical test and result analysis

The residual series obtained from the fitting results of regression (2) are subjected to a stationarity test. The Augmented Dickey-Fuller (ADF) test statistic is -3.876, with an absolute value exceeding the critical value of -3.000 at the 5% significance level, leading to the rejection of the null hypothesis of a unit root. Therefore, the residuals are stationary, completely eliminating the possibility of model spurious regression. Additionally, the Breusch-Pagan (BP) test results indicate a p-value greater than 0.05, suggesting the absence of heteroscedasticity.

Table. 9 Breusch-Pagan test results

Breusch–Pagan/Cook–Weisberg test for heteroskedasticity
Assumption: i.i.d. error terms
Variables: All independent variables
H0: Constant variance
chi2(6) = 6.28
Prob > chi2 = 0.3924

According to the results of Regression (2), R^2=0.96, and the overall goodness of fit of the model is high. Among them, the average import price of pulp passes the significance of 10% and the influence coefficient is negative, indicating that for 1 unit increase in the import price of pulp, China's import of pulp will decrease by 0.75 units, which is in line with the expectation of economic significance. As a global resource, the price of pulp reflects the supply and demand relationship in the international market. China's export pulp price is higher than the international average price and lose competitiveness, and the lower import price will encourage the growth of China's import volume. The reality of a large number of imported pulp will make us become the price taker rather than the participant. Our country should be committed to solving the imbalance between supply and demand in the domestic pulp market and improving the competitiveness of our own pulp products.

In addition, the influence coefficients of China's GDP, per capita pulp consumption, annual average exchange rate and waste ban policy are in the same direction as expected. Gross national product can reflect the increase in consumption level and demand caused by the expansion of economic scale, while the per capita pulp consumption can more specifically reflect the demand size of the domestic pulp industry, in the case of domestic pulp cannot meet the demand will inevitably

lead to the increase in pulp imports; The RMB exchange rate also shows a negative impact on pulp imports. The pulp market in China is a spot market, and the change of exchange rate will affect the import price of pulp. Under certain conditions, a decline in the exchange rate facilitates imports by making the domestic currency appreciate abroad.

Wastepaper import volume shows a positive effect on pulp import, which is opposite to the expected direction. As the wastepaper and imported pulp under HS47 are not substitutes, but complements. Waste pulp and wood pulp are the basic industrial raw materials for paper making, and waste pulp is mainly derived from wastepaper recycling. In fact, wastepaper and pulp need to be used in proportion in the paper production process, and wastepaper import has a synchronous impact on pulp import. At the same time, this further shows the rationality of the non-significant waste prohibition policy in the regression results: although the concept of resource and environmental protection is to reduce the entry of foreign garbage, the import of wastepaper cannot be completely banned at the moment, and the effect of the waste prohibition policy has a lag.

4. Conclusion and suggestions to ensure the safety and interests of China's pulp import trade

Based on a quantitative and qualitative analysis of the current situation of pulp production and consumption in China, the scale of pulp imports, the structure of imported goods, and the countries of origin, this study concludes that, in a domestic environment where pulp production is stabilizing or even slightly decreasing, maintaining an annual growth rate of approximately 3% in domestic pulp consumption serves as a point of demand for imports. Approximately 90% of pulp imports in China consist of wood pulp with higher environmental requirements, and the sources of imports exhibit new concentration characteristics. Regression results on factors influencing pulp imports indicate that China's pulp production, as a critical component of domestic supply, urgently needs to be strengthened, while paper and paperboard, as downstream finished products, significantly drive pulp import volume. Moreover, global pulp production and average import prices serve as significant international market factors affecting China's pulp imports. In conclusion, the policy implications of this study are as follows:

4.1. Enhancing the domestic supply of pulp

4.1.1 Intensifying R&D

Advanced production technologies can not only achieve cost savings but also improve production efficiency and output, thereby alleviating the heavy reliance on imported pulp and reducing the risks associated with pulp import trade. Related paper enterprises can enhance their competitiveness, increase market share, and achieve long-term steady development. The government should also improve relevant policies and regulations to provide strong support for innovation in China's pulp industry. In addition, attention should be paid to the issue of paper recycling. Due to the lack of a systematic paper recycling network, the utilization rate of waste paper in China is not high. High-quality waste paper from abroad, usually made from wood pulp, is often used as a substitute for imported pulp. Therefore, increasing the rate of waste paper recycling can alleviate the pressure of imported pulp and indirectly increase domestic supply. It is necessary to actively promote the research and development of waste paper recycling technologies, establish corresponding recycling standards, strengthen public education, advocate for the classification and recycling of waste paper, in order to improve recycling efficiency and quality.

4.1.2 Accelerating the construction of "forestry-pulp integration"

China needs to further promote the construction of "forestry-pulp integration" projects, actively develop eco-friendly papermaking, enhance the natural regeneration capacity of forests, and embark on the path of sustainable development in the paper industry. The government and large-scale paper enterprises should actively promote the construction of raw material forest bases and emerging

artificial commercial forests, establish a forest management system and management mechanism. This will help improve the security of pulp materials and attract significant domestic and foreign capital investment, thereby reducing production costs and increasing the domestic production of pulp.

4.2. Adjusting import trade policies

China's zero-tariff policy on imported pulp aims to protect domestic forest resources. However, due to the further expansion of China's pulp trade deficit, moderate trade protection measures can be taken by imposing import barriers on pulp produced in other countries. Simultaneously, tariffs should be exempted on pulp produced in pulp base developed overseas by China; export tax rebates for paper products manufactured using imported pulp should be eliminated. Furthermore, the government can issue import quotas to import companies and control them; import pulp enterprises should be given preferential loans and subsidy funds to maintain the legitimate rights and interests of domestic industries, stimulate their enthusiasm for pulp production and consumption.

4.3. Developing diversified import channels

In order to reduce import risks, we should carefully select the countries of origin for imports. On one hand, it is advisable to choose countries with lower risks as import sources. For example, priority should be given to importing from developing countries such as Brazil, Chile, and Indonesia, which have rich natural forest resources and competitive import prices compared to developed countries. Building on this foundation, cooperation with these countries can be considered through the establishment of joint ventures to promote mutually beneficial outcomes. On the other hand, exploring new pulp import markets by leveraging international platforms such as the "Belt and Road" Initiative and the ASEAN Free Trade Area to seek out more resource-rich countries and regions. Emerging market economies such as South Africa in Africa, Mexico and Argentina in the Americas, Thailand and the Philippines in Asia show great potential in this regard. These regions not only demonstrate significant potential for development but also provide a relatively stable trade environment, making them key areas for prioritized development in China.

4.4. Competing for the pricing power in the pulp market imports

Although China is currently one of the largest importers of pulp in the world, and its import volume is significantly influenced by international pulp production, Chinese pulp prices have long been in a passive position in the international pulp trade market. For a long time, Chinese paper enterprises have acted independently in the import market, with some companies competing to lower prices in the export market while others strive to raise prices in the import market. This behavior has accelerated the increase in pulp import prices, leading to a reduction in trade welfare. Relevant industry associations and the government should establish a system for negotiating pulp imports, strengthen trade negotiations with pulp-producing countries, strive for better import conditions and prices, and ensure fair treatment of China's import trade. China can combine its pulp import industry and other non-advantageous bulk industries with China's advantageous bulk commodities and industries to form a community of shared interests, thereby increasing China's bargaining power in pulp trade negotiations. In addition, for countries or regions with abundant forest resources but underdeveloped paper industries, we should make significant investments in overseas papermaking and pulping bases to supply relatively inexpensive and stable pulp to China, gradually gaining control over the international pulp market

References

[1] Cheng, N. & Liu, J. C. Analysis of import sources of main forest products in China [J]. Forestry Economics,2006(03):44-48+52.

[2] Xiong Xiaokun. Research on the development of China's pulp import trade [J]. Reform and Strategy,2017,33(08):185-187.

[3] Policy frequent China pulp import structure quietly changes [J]. Paper Equipment and Materials,2020,49(04):3.

[4] Wang, Y. & Wang, Y. The factors and countermeasures of our country's pulp trade deficit [J]. Reform and Strategy,2017,33(05):148-149+167.

[5] Jiang, S. & Nie, Y. Analysis and countermeasure of trade deficit of Pulp in Our country [J]. Chinese Forestry Industry,2008, No.56(08):42-45.

[6] Wang, Q. & Wang, L. Analysis of import and export changes and Influencing factors of wood pulp in our country before and after entering WTO [J]. Productivity Research,2008(09):80-81.

[7] Wang, H. & Sui, D. Current situation, Influencing factors analysis and development countermeasures Research of China's pulp import Trade [J]. Economic Forum,2019(02):116-120.

[8] CAI X Y, Tian M H, CAI F, et al. Empirical analysis on the influencing factors of wood pulp import in China [J]. Forestry Economics,2013, No.251(06):58-69.

[9] Xu, H., Xu, Y. & Bai, X. Research on trade deficit of Pulp in Our Country [J]. China Paper,2017,36(11):63-69.

[10] Chen, H; Zhang, Y; Tian, G. Study on Quality Measurement and Influencing Factors of Russian Wood Forest Products Imported from China under the Background of High-Quality Development[J]. Sustainability,2023

[11] Xiao, Y., Tong, W. & Wang, Z. Heterogeneity analysis of factors influencing the import trade of forest products in China [J]. World Forestry Research,2023,36(03):121-127.

[12] He, C. & Miao, D. Ling. Risk assessment and mitigation countermeasures of pulp import in China [J]. Problems in Forestry Economics,2018,38(03):69-73+108.

[13] Diao, G., Cheng, B., Li, X. et al. Risk analysis of timber import in China [J]. Forest Resources Management,2014(02):21-25.

[14] Yu Qiulin. Analysis on the risk avoidance countermeasures of forest products import and export trade [J]. Shopping Mall Modernization,2013, No.730(25):67-68.

[15] Li, Q. Import volume is still difficult to lose pulp price is still dominated by shock [J]. Paper Information,2023, No.433(02):26.

[16] Wang, R. & Jiang, Y. International comparative study on dependence degree of import trade of forest products in our country [J]. Journal of Anhui Agricultural Sciences,2020,48(07):244-249.

[17] Zhang, R. & Song, W. et al. Analysis of influencing factors of paper and board import trade in China [J]. Forestry Economics,2015,37(05):52-57.

Appendix

Table 8-1 Johnson test critical values Table.

Table/Case: 1*			
(assumption:	intercept	in CE)	
	H0:	Max-lambda	Trace
	0	46.45	131.7
	1	40.3	102.14
	2	34.4	76.07
	3	28.14	53.12
	4	22	34.91
	5	15.67	19.96
	6	9.24	9.24

Table 8-2 Johnson test critical values Table.

Table/Case: 1			
(assumption:	intercept	in VAR)	
	H0:	Max-lambda	Trace
	0	45.28	124.24
	1	39.37	94.15
	2	33.46	68.52
	3	27.07	47.21
	4	20.97	29.68
	5	14.07	15.41
	6	3.76	3.76