

On the Goal and the Path of the Optimization of Macao's Industrial Structure

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From the perspective of development economics, industrial structure has always been one of the priorities of economic reform. Meanwhile, as a major means to achieve sustainable development of the economy, industrial structure has drawn great attention from the government of each country. By contrast, the Macao Special Administration Region (SAR) is confronted with prominent issues in industrial structure. However, the Macao SAR Government's response is not based on development economics. Up to now, it still repeatedly stresses moderate diversification of Macao's economy. The academic circle has been coming up with various interpretations of "moderate diversification". But what is the goal of moderate diversification? How to achieve this goal? What is the choice of path for this goal? It seems that a systematic and comprehensive theory regarding this has yet to be formed. This paper attempts to utilize optimization theory to propose the optimization goal for Macao's industrial structure and identify specific choice of optimization path in the hope of offering theoretic basis to the SAR Government in promoting moderate diversification of its economy so as to facilitate the realization thereof.

I. The Definition of Optimization Goal

The academic circle has been unable to explicitly explain the goal of moderate diversification of Macao's economy. Why? The major reason is that the word "moderate" is so neutral that the academic circle has been adopting a research methodology that avoids the important and dwells on the trivial. Therefore, it is completely understandable that the discussions have been focusing on how to be "moderate" instead of what is "moderate". Since it is difficult to define the goal of being "moderate", we can achieve moderate goal through optimization goal. My understanding of optimization goal is as follows. First, optimization goal's research objects mainly include supererogation and rationalization of the industrial structure, which are closer in meaning to that of moderate. Second, with theoretical foundation the industrial structure supererogation and rationalization are easy to define and suitable for quantitative analysis. Third, the economy itself follows the development pattern shifting from imbalance to balance and the optimization theory constitutes the means to achieve balanced growth from imbalanced state. When the development emphasizes rationalization, the industrial structure tends to become balanced; when the development emphasizes supererogation, the industrial structure tends to become imbalanced.

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Then how to define the optimization goal for Macao's industrial structure? This paper offers the following definition by taking into consideration Macao's inherent development features, such as mini economy, former capitalist system, free port system and the "One Country, Two Systems" policy, etc.:

1.1 Macro optimization goal: capital-intensive model → knowledge-intensive model

From the macro perspective, the optimization goal for Macao's industrial structure should be a shift from capital intensive to knowledge intensive model. How to define the shift from capital intensive to knowledge intensive model as macro optimization goal is mainly based on a development characteristic of the history of industrial development. It can be found that it has generally taken over three decades for some emerging economies such as Singapore, Taiwan, South Korea and Hong Kong to make the shift from capital intensive to knowledge intensive model. The length of time it takes is closely related to the period of time identified by the policy planning. As 30 years should belong to long-term policy planning, it is defined as macro optimization goal. The academic circle generally has reached a consensus that the Macao SAR's rapid economic growth in the past 13 years is a result of capital-intensive development. It is well known that most of the capital which derives from foreign direct investment (FDI) has gone into gambling-related sectors. As statistics released by Statistics and Census Service indicate, the aggregate total of FDI increased to MOP 118.896 billion in 2011 from MOP 25.876 billion in 2002, respectively accounting for 40.3% of GDP in 2011 and 29.07% of GDP in 2002. Among them, the aggregate total of investments in the gambling sector increased to MOP 67.797 billion in 2011 from MOP 15.106 billion in 2002, respectively accounting for 57% of total FDI in 2011 and 58.37% of total FDI in 2002. It can be seen that capital-intensive development has been the mainstream since the establishment of Macao SAR and the capital has mostly flown to gambling related sectors. In the future, Macao's industrial structure should make the shift to knowledge-intensive development, which is in line with international development trend and Macao's inherent development characteristic. While most developed countries in the West have embarked on knowledge-intensive development, Japan, Singapore and South Korea are the only oriental countries that can closely follow such development. Therefore, many countries in the East are trying to leverage their late-mover advantage to implement reforms so as to catch up with the knowledge-intensive development. As a mini economy, Macao has neither natural resources nor foundations for light or heavy industries. This demands that Macao neither maintain capital-intensive model, nor make the shift to technology-intensive model, nor highly rely on the gambling sector. Instead, it should pursue knowledge-intensive development. However, knowledge-intensive model, which puts emphasis on knowledge innovation as well as technology innovation, is generally regarded as a type of growth driven by R&D. It is directly related to the government investment in R&D. While it is not impossible for Macao to pursue a path of development driven by R&D, it will face many difficulties along this path due to constraints of its conditions. Therefore, this paper proposes that Macao can first pursue service-oriented knowledge-intensive development by generating high-quality service through knowledge. When its conditions become mature, it can pursue knowledge-intensive development driven by R&D.

1.2 Meso optimization goal: decreased the ratio between secondary and tertiary sectors' output value

From the meso perspective, the optimization goal for Macao's industrial structure should be decreased ratio between secondary and tertiary sectors' output value. This is mainly based on the industrial structure's development features, among which the proportion of output value and the proportion of employment constitute the measurements of industrial structure. Macao's industrial structure takes the shape of "tertiary and second structure pattern", in which the proportion of tertiary sector is high and the proportion of secondary sector is low. In 2011, the ratio between tertiary and secondary sectors' output value is 93.57:6.43, highlighting the prominent issue of structural imbalance. Gambling business dominates the tertiary sector. Considering gambling business' specialness, vulnerability and high dependence on the outside world, the meso optimization goal for Macao's industrial structure should be decreased ratio between secondary and tertiary sectors. It should mainly encompass two aspects: first, the ratio between secondary and tertiary sectors' output value should be decreased; second, the ratio between secondary and tertiary sectors' employment should be decreased. As to what extent should the decrease be so as to facilitate moderate diversification of economy, we can still learn from the history and make a judgment based on the reality although theoretically there is no way to make an estimate because the theorists have yet to offer a clear definition of "moderate" and there is no international standard for the industrial structure of mini economy. As indicated by Macao's economic development in the 1980's, the ratio of output value between secondary and tertiary sectors was as high as 60:40, i.e., the proportion of tertiary sector's output value was 60% and the proportion of secondary sector's output value was 40%. Judging from either economic cycle or establishment of competitiveness, the ratio of output value between Macao's sectors should gradually decrease from the current 93.57:6.43 to 70:30 or 60:40. If it decreases to 70:30, it will return to a reasonable range in which the negative impact of predominant gambling business on the economic development can be offset. If it decreases to 60:40, it will become a reasonable range with considerable competitiveness. In this case, it may not only contend against the predominance of gambling business, but also transform special service type of competitiveness into technology production type of competitiveness, which is believed to be the goal closest to moderate diversification of economy pursued by the society.

1.3 Micro optimization goal: effective market supply

From the micro perspective, the optimization goal for Macao's industrial structure should be effective market supply. This is mainly based on the fact that production efficiency is determined by effective market supply. To put it in a nutshell, effective market supply refers to a scenario in which all production factors can be freely regulated through the market. Effective market supply is specifically characterized by complete openness, information symmetry, transaction costs, market order and risk mitigation. The government will make proper intervention when necessary to avoid failure of effective market supply. If the Macao SAR can maintain effective market supply, it will attract foreign direct investment under the aura of the "One Country, Two Systems" policy and mainland China's large market as long as the Macao SAR Government rolls out policies in a timely manner to guide the capital to the secondary sector. Combined with innovative spirit of entrepreneurs, it can increase the output value of secondary sector so as to decrease the output value of tertiary sector. Of course, it is no easy task to maintain effective market supply.

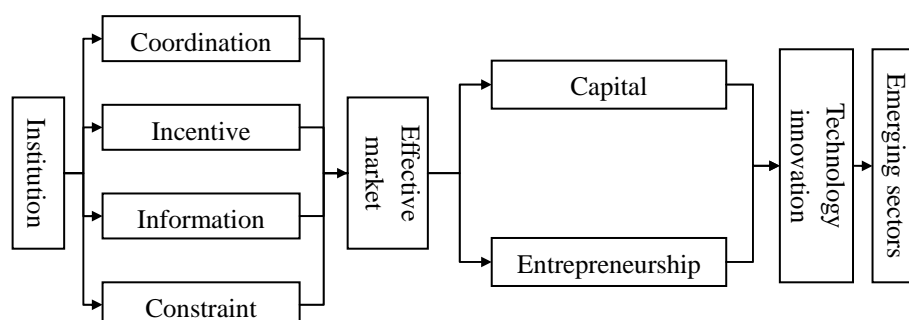
Theoretically, first, property rights system should be improved to rigorously crack down on acts of tort; second, a free and open economy should be established to allow free flow of capital, commodity and information; third, anti-monopoly law and anti-unfair competition law should be stipulated to build an orderly and fully competitive market; fourth, the transaction costs, most of which are administrative fees imposed by the government, should be reduced.

II. Optimization Reasoning

2.1 Theoretical foundation

The theoretical foundation mainly stems from institutional economics and market economics. As can be seen from Figure 1, the institution's coordination, incentive, constraint and information functions can be given full play through timely institutional reform (inductive + compulsory) so as to maintain effective market supply. With effective market supply, it will attract foreign direct investment and local funds, which will then flow into the market. Once the market has sufficient funds, the innovative spirit of entrepreneurs will be inspired as long as the government provides timely policy guidance. Once the innovative spirit of entrepreneurs and the capital achieve the coupling effect, it will generate technology innovation so as to develop emerging sectors.

Figure 1: The Logic of Institution, Capital and Industrial Optimization



2.1.1 Institutional innovation and effective market supply

Generally speaking, with coordination, incentive, information and constraint functions, the institution can govern the market operation to form effective market. Under the institution of effective market, the risk of market transaction can be reduced and the market order can be enhanced so as to suppress market opportunism and boost mutual interests and co-existence of both parties to the transaction, streamline the cognition task of processing market information, and eliminate forward ignorance and primordial fear regarding the transaction. However, the institution of effective market may not hold good for all time since it is subject at any time to the impact of opportunism and act of self-interest, which may thwart complicated transaction and render the market institution to fail. At time like this, the government should carry out the institutional innovations especially in definition and protection of property rights, market regulation and information mechanism to address market failure through measures such as legislation, executive laws and regulations, and policy formulation so as to restore the market's functions of free regulation and rational allocation.

2.1.2 Effective market supply accelerates capital operation and inspires entrepreneurship

Competitive market is a major factor that influences production and technology progress, human capital investment and entrepreneur capabilities. The institution of effective market not only ensures market competitiveness but also accelerates (human and currency) capital investment and inspires entrepreneurship so as to determine the progress of production technology. This is because effective market supply plays an important role in knowledge coordination, transaction fee (political market cost) reduction, stabilization of expectation and formation of certain order. These factors constitute primary conditions for accelerating the flow of foreign direct investment and local capital. The accelerated flow and operation of capital is bound to give rise to capital market, from which financial leverage is bound to derive, creating an environment for venture investment. One component of entrepreneurship is the willingness to take risks. Therefore, it is easy to achieve the coupling effect when the environment for venture investment interweaves with entrepreneurship.

2.1.3 The coupling effect between capital and entrepreneurship determines technology innovation and emerging sectors

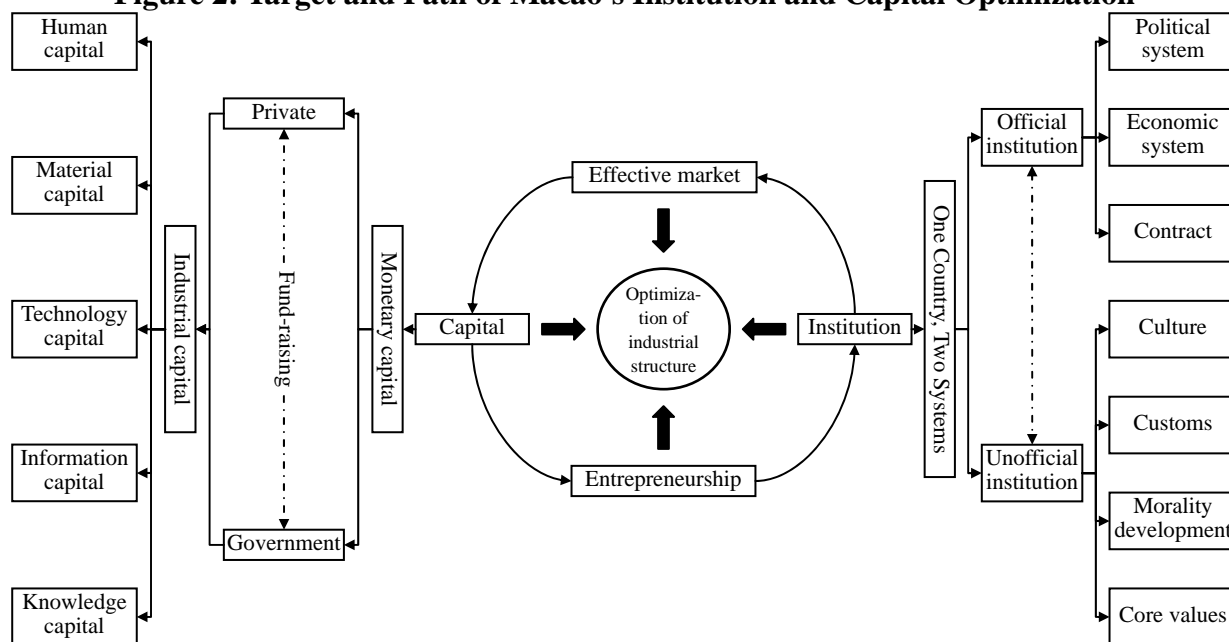
Schumpeter points out that the modern industrial system can only be established by relying on innovation and the credit is crucial to the realization of innovation.¹ There is no denying that technology innovation optimization serves as the core driving force for emerging sectors and provides entrepreneurs with potential opportunities to make profit in the market. According to Schumpeter, innovation means introduction of "new combinations" into a new system and "changes in production function". With the emergence of technology innovation, the marginal returns of production factors will be increased so as to promote the re-investment of production factors and lead to sustained growth of economy. In other words, technology innovation enables re-invested factors to be still profitable so as to induce further investment. The re-investment of production factors, which can be understood to be "new combinations" mentioned by Schumpeter, will attract further investment and give rise to emerging sectors, whose high added value can boost economic growth. Driven by the technological progress, resources and production factors move from sectors with lower productivity to sectors with higher productivity. As a result, the development of sectors with higher productivity will be given priority while sectors with lower productivity will be phased out and eliminated so as to optimize and upgrade the production structure and economic structure.² In the process from the capital to technology innovation, entrepreneurship plays an irreplaceable role.³ However, in the final analysis, it is the influence of institution that contributes to the coupling effect between capital and entrepreneurship as well as technology innovation. Institutional changes and technological changes constitute the fundamental core of social and economic evolution. According to Louis, factors that contribute to a country's economic growth are interrelated. If more capital is obtained from abroad, this may have relevance to new technology and even exert influence upon the institution and the attitude of people; if new knowledge is discovered, the investment will be spurred and the institution will also be subject to its impact; if the quality of institution improves, technology innovation may increase and more knowledge and capital may also be applied to the production. As a basic decisive force, technology innovation promotes changes to the institution. While the institution undergoes constant changes, it increasingly becomes a decisive force for technology innovation. First, the market system encourages high level of capital allocation, which leads to technology innovation as an inevitable choice of maximizing interests. Second, it inspires entrepreneurship. Both the optimization of

institution, especially that of the system of right of private ownership of property and the reduction of transaction costs greatly inspire entrepreneurship, the driving force of which is the maximization of interests. When entrepreneurs engage in technology innovation despite all kinds of risks, they actually do an accurate calculation of costs and returns. When the technology innovation succeeds and immediately becomes a patent, the market value it will generate may well be many times the investment. Many studies indicate that as innovators and stake-holders entrepreneurs keep working on new technology⁴ and creating new products⁵ while taking into account the risk of uncertainties and bearing the consequences of making decisions amidst uncertainties.⁶

2.2 Optimization reasoning

In the light of Macao’s macro, meso, and micro optimization goals for its industrial structure, the optimization reasoning mainly focuses on how to give full play to the institutional advantages of “one country, two systems” and the comparative advantage of ample government finance. First, effective market supply can be achieved by giving full play to the institutional advantage of “one country, two systems”. Under the “one country, two systems”, with the high level of autonomy granted to the Macao SAR by the *Basic Law of the Macao Special Administrative Region of the People’s Republic of China* (hereinafter as “the Macao Basic Law”) the SAR Government can promote institutional reform through independent legislation and amendment (inductive and compulsory) to achieve effective market supply. Second, the comparative advantage of ample government finance can be leveraged to encourage entrepreneurs’ innovative spirit, supply of industrial capital and inductive supply of industrial policy. With effective market supply, which can better attract foreign direct investment, and with effective use of ample government finance, which includes measures such as policy subsidy, interest-free loan for production, R&D investment, and exemption of taxation, entrepreneurs’ innovative spirit and industrial capital supply will be stimulated so that the market possesses the soft and hard conditions for developing emerging sectors. (Figure 2)

Figure 2: Target and Path of Macao’s Institution and Capital Optimization



2.2.1 Achieve effective market supply by making the most of institutional advantages of the "One Country, Two Systems" policy

Macao enjoys unique institutional advantages under the "One Country, Two Systems". From the perspective of development, such advantages are as follows. First, independent policy-making. The Macao SAR Government can draw up and implement related policies according to the needs of sustainable development, such as land policy (Article 7), taxation policy (Article 106), etc. Second, independent finances. Article 104 of the Macao Basic Law stipulates that "the Macao Special Administrative Region shall have independent finances. All the financial revenues of the Macao Special Administrative Region shall be managed and controlled by the Region itself and shall not be handed over to the Central People's Government. The Central People's Government shall not levy taxes in the Macao Special Administrative Region." This Article emphasizes the fact that the Macao SAR will independently make decisions and manage its revenues and expenditures while the Central Government does not stipulate financial systems and policies for the Macao SAR. In other words, Macao's financial operation is completely separate and independent from that of the Central Government. Third, independent legislation. The Macao SAR enjoys legislative power (Article 17). Legislative power can generate an official institution, which generally has binding and stimulating, fair and efficient functions. Besides, Macao can continue to practice the original capitalist system so as to make full use of the positive aspect of original capitalism, such as the status of a free port (Article 110), the policy of a free trade (Article 111) and the protection of the right of private ownership of property (Article 6). Through independent legislation and institutional reform (inductive and compulsory), the Macao SAR Government can achieve effective market supply. What the SAR has to do is not only to proceed from official institution but also to promote the situation with unofficial institutions. As to the official institution, the reform of political system mainly aims to ensure well-regulated politics, honesty in performing one's official duties, and handling affairs in conformity with legal provisions so as to prevent officials' collusion with merchants and political rent-seeking; the reform of economic system mainly aims to ensure mitigation of transaction risks, improvement of market order, suppression of market speculation, reduction of burden of distinguishing market information, elimination of forward ignorance and primordial fear regarding transactions so as to prevent market monopoly and unfair competition; the contract reform mainly aims to ensure the validity of contract spirit and crack down on breach of contract. As to the unofficial institutions, carrying forward Chinese culture, especially Confucius thought of harmony, is of crucial importance to the building of a harmonious society; both Portuguese customs and Macao's local customs should be maintained so as to realize mutual integration and co-existence; great importance should be attached to morality development, which especially applies to major officials of the SAR Government who are held accountable and must stand on the moral highland and lead by example so that the society will follow suit; the core value of "love China, love Macao" should be consolidated and national education should be enhanced through educational reforms. Theoretically, the reform of official institutions will exert influence on unofficial institutions. On the contrary, the reform of unofficial institutions will also exert influence on official institutions. The SAR Government can make the most of institutional advantages of the "One Country, Two Systems" and take two-pronged approach at the same time by addressing both official and unofficial institutions so as to better establish effective market supply.

2.2.2 Leverage the comparative advantage of ample government finance to encourage entrepreneurs' innovative spirit, supply of industrial capital and inductive supply of industrial policy

First of all, the SAR Government must formulate sound macro, meso and micro goals, among which there exists vertical logical relationship as defined by this paper's optimization goal for industrial structure, i.e. the micro goal can promote the meso goal while the meso goal can promote the macro goal. In simple terms, as long as effective market supply is guaranteed and government's financial policies are available, it can contribute to the decrease of the ratio between secondary and tertiary sectors' output value. Combined with government's financial policies, Macao's industrial structure can finally make the shift from capital-intensive to knowledge-intensive model. Second, nongovernmental forces, which include industrial associations, professional organizations, social entities and foreign ventures, should be mobilized. As demonstrated by international experience, generally speaking the industrial capital is raised when the government contributes money, foreign capital provides technology and the industry supplies human power. Through organic cooperation, the spillover of foreign capital's technology is absorbed as we "learn from work". However, it is worth noting that as a micro economy Macao is subject to the constraints of objective conditions such as weak development foundation. Therefore, the advantage of ample government finance should be leveraged with more focus in the long term that must be in line with the goal. Finally, if the SAR Government sets about optimization of industrial structure according to the goal defined by this paper, short-, medium- and long-term industrial capital building plans and financial policies should be formulated. For example, when it comes to human capital, the SAR Government has made vigorous efforts to invest in 15-year free education in recent years. Strictly speaking, it does not belong to investment in human capital because what 15-year free education covers belongs to the stage of basic education while human capital as production factor belongs to the investment stage and can be productive right after investment. Therefore, building human capital falls into the category of productivity intended for professionals. Material capital mainly refers to software and hardware facilities. Software facilities include education level, air quality, environmental sanitation, social fairness and clean government etc. Hardware facilities include highway, bridge, telecommunication, hospital, and pollution-free disposal of waste etc. Technology capital refers to reproductive capability of production. As the new source of energy will be the trend of future development, the investment in new energy technology can be considered. Information capital refers to the innovation of internet technology which can obtain huge amount of information at a low cost. As 4G will be the trend of future development, preparations should be made early. Knowledge capital refers to knowledge creation and technological R&D. The building of knowledge capital is an indispensable link that Macao needs to shift from capital intensive to knowledge intensive development. The SAR Government can increase investment in R&D. Finnish government's investment in R&D accounts for 4% of its GDP, which explains why Finland achieved knowledge intensive development earlier than other European countries.

III. The Choice of Path

3.1 The choice of path for the shift from capital-intensive to knowledge-intensive development

The SAR Government has the following paths to choose if it intends to achieve the goal of shifting from capital-intensive to knowledge-intensive development:

First, the education subsidy pattern should be revamped. The SAR Government should adjust its education subsidy policy. The present 15-year free education for kindergarten up to senior high school should be revised to 16-year free education for primary school up to college and extended to 12-year free education for middle school up to study for doctor degree, all of which can be carried out in stages. The change of this subsidy pattern will help encourage Macao residents to pursue higher degrees and seek more profound knowledge; it will also help parents better fulfill the obligation of educating their children; it can even help Macao make the shift from capital-intensive to knowledge-intensive development.

Second, build knowledge capital. The core of knowledge-intensive development is knowledge, creation and R&D. The SAR Government can build knowledge capital by itself or have private players build it. If the SAR Government chooses to build knowledge capital by itself, it is suggested that national development fund be established and directly invested in national scientific research projects so as to leverage the national force to drive its own growth; or the SAR Government can build labs by itself and introduce scientific researchers to conduct R&D. Besides, the SAR Government can team up with industrial and academic circles to build knowledge capital. A typical successful example is the concept of developing state innovation system proposed by Finland a few years ago. However, in order to emulate Finland the SAR Government has to hike the expenditure in R&D to account for 4% of its GDP. Therefore, the fundamental path to building knowledge capital is effective investment of funds.

Third, enhance cooperation between Macao and Guangdong. Adjacent to Guangdong, Macao enjoys favorable geographic advantage. In 2009, the State Council approved and issued "Overall Development Plan of Hengqin Island", which to a large extent aims to promote moderate diversification of Macao's economy. The hi-tech zone proposed by the Plan serves as the best breakthrough point to guide Macao toward knowledge-intensive development. In 2011, Guangdong provincial government and the government of Macao SAR signed *Framework Agreement on Cooperation between Guangdong and Macao* in Beijing. Under Article 3 of the Agreement, which stipulates the cooperation between Macao and Nansha of Guangzhou, the advantage of Guangzhou being developed as a national central city shall be leveraged; the coordination between Macao's industrial development plan and that of Nansha Guangzhou shall be enhanced; and cooperation with Macao's cultural and creative industries, port logistics industry, and TCM industry shall be promoted. As two major pivot points for the cooperation between Guangdong and Macao, Hengqin and Nansha are breakthrough points for the upgrade and transformation of Macao's industrial structure.

Fourth, urge residents to continue professional study and increase their value. At present, the MOP5,000-worth advanced studies program offered by the SAR Government aims at popularization and interest-driven study instead of professional study. Therefore, this program only makes limited contributions to Macao in its knowledge-intensive development. In order to promote knowledge-intensive development, the advanced studies program has to be upgraded from

popularization to professionalism. Before the implementation of this program, the SAR Government should establish professional certification systems for all trades so as to regulate the job market where certificate is needed for every position; a subsidy application threshold should be set so that qualified applicants can receive full or part of government subsidy. In this way, the resources will be devoted to those highly-motivated individuals so as to match the input with the output. If the SAR Government can keep urging residents to continue professional study and increase their value, Macao is bound to make the shift from capital-intensive to knowledge-intensive development.

3.2 The choice of path for decreased ratio between secondary and tertiary sectors' output value

The SAR Government has the following paths to choose if it intends to decrease the ratio between secondary and tertiary sectors' output value.

First, make politics clean and transparent. If the government can make politics clean and transparent and roll out appropriate reforms, the politics will be able to influence the economy and the power will be able to establish ties with the capital. In this way, the industrial policies will be consistent and immune from the influence of political rent-seeking, making it possible for industrial structure to adjust toward supererogation and rationalization. On the contrary, if the government fails to make politics clean and transparent and roll out appropriate reforms, the economy will be able to influence the politics. In this case, the industrial policies may be distorted by political rent-seeking, making it impossible for industrial structure to adjust toward supererogation and rationalization. Since its establishment 15 years ago, the Macao SAR has been beset by the imbalance of industrial structure and the moderate diversification of its economy has made little progress, which to some extent reflects the lack of sufficient transparency in politics. As the capital has established ties with the power through various rent-seeking methods, Macao's industrial policies have always favored the gambling sector and even the government has been hindered from formulating new industrial policies. If the SAR Government intends to decrease the ratio between secondary and tertiary sectors' output value, it must make full use of institutional advantages of the Special Administrative Region – executive-led polity. The reform can be pushed forward through executive-led polity. The politics can be made clean and transparent through reform. The main purpose is to fight against corruption and monopoly. First, reform the institutions related to Commission against Corruption as well as audit and increase the scope of power to crack down on collusion between officials and merchants and social decadence. Second, reform the government departments to break the power monopoly and market monopoly.

Second, formulate industrial policies for electric vehicle, TCM (biotechnology) and 3D printing. In order to decrease the ratio between secondary and tertiary sectors' output value, the SAR Government can achieve this goal by formulating industrial policies for electric vehicle, TCM (biotechnology) and 3D printing. (1) The replacement of traditional gasoline powered car by pure electric vehicle is the general trend. Second, traditional gasoline powered car emits a large amount of carbon dioxide and carbon monoxide, which are main factors that contribute to the earth's greenhouse effect. Climate abnormalities caused by the greenhouse effect have subjected many countries to natural disasters of various degrees. Human beings are extremely anxious to replace and upgrade traditional gasoline. At present, China has basically mastered super capacitor battery electric vehicle technology. Once this technology is firmly within China's grasp, China is expected

to draft standards for electric vehicle given its huge domestic auto market, making it possible to lead the third industrial revolution and changing the fate of being marginalized in the previous two industrial revolutions. If the SAR Government can grasp the opportunity regarding China's drive to develop electric vehicle and establish a national development fund⁷ to invest in R&D and production of super capacitor battery by leveraging its comparative advantage of ample government finance and institutional advantage of "one country, two systems", it will not only increase the proportion of Macao's secondary sector's output value but also support the upgrade of local traditional auto service. (2) TCM (biotechnology) will become a new medical option for the humanity. Confronted with looming crisis of disease, the development of Western medicines has proved that they only treat the symptom but not the root cause. The growth of TCM can make up what the Western medicines lack. The combined use of TCM and Western medicines should be able to address both the symptoms and root causes. China's 12th Five-year Plan makes it clear that TCM sector is the focus of national development drive and Macao can participate in it. The TCM Industrial Zone jointly built by Guangdong and Macao has been put into operation. According to Article 4 of *Several Policies Regarding Further Support for the Development of Biopharmaceutical Industry* issued by Zhuhai Municipal Government in August 2013, "the focus of R&D in the TCM field includes TCM injections, TCM compound recipe, antiviral agent, and TCM antitoxic agent." (3) It is a hard fact that 3D printing technology will lead the future technology innovation. As 3D printing technology will have revolutionary impact on industrial design and application, Macao can leverage 3D printing technology to promote the development of cultural and creative industries and apply innovative design to industrial development. If Macao's cultural and creative industries highlight its unique features, it can increase the proportion of secondary sector's output value so as to narrow the difference with the proportion of output value of tertiary sector.

3.3 The choice of path for effective market supply

The development experience of the world indicates that three major rules are indispensable to the building of an effective market supply:

3.3.1 Adherence to contract spirit

Adherence to contract spirit is an inevitable choice to ensure effective market supply. Although the statutory law is implemented in Macao, where contract spirit is adhered to, the risk and cost of adhering to contract spirit by the market are increasingly higher due to system loopholes and legal hysteresis. The SAR Government can review the contract-related articles in the current Commercial Code to adjust to the latest developments. For instance, with drastic increase of the trading volume on the internet, does the law have the binding force on internet-based transactions? As contract represents a spirit to be bound to the system, the whole society should adhere to contract spirit. Enhanced supervision in the system and law enforcement is an inevitable path of choice.

3.3.2 Protection of property rights

Protection of property rights is an inevitable choice to promote innovation and competition in effective market supply. Macao is subject to many international conventions regarding intellectual property rights, such as Universal Copyright Convention and Paris Convention on the Protection of Industrial Property. However, Macao still uses *Regime Jurídico da Propriedade Industrial* (*Industrial Property Code*) approved by Decree-law No. 97/99/M before it was returned to Chinese rule. Compared with Hong Kong, Macao still falls short in terms of protecting property rights as

illustrated by the recent “public antenna incident” which involves the protection of copyright. Actually, both protection of property rights and adherence to contract spirit belong to institutional issues and are closely related to legal terms. Legal reform is the only path of choice in order to better protect property rights.

3. Moderate government intervention

When the market is out of order, it is necessary for the government to conduct moderate intervention. As Macao enjoys a high degree of autonomy, the SAR Government has the necessary condition to conduct moderate intervention under executive-led polity. There are probably three approaches for the government to intervene in the market: legislation, executive order and policy. As legal intervention produces a formal institution at a rigid cost, extremely high social costs have to be paid to revise or nullify it in case the legal intervention turns out to be wrong. As executive order is not subject to the vote of legislative assembly, it does not belong to a formal institution. Although it is not as rigid as legislation, frequent changes made by the government will also incur social costs and make it hard for the market to adjust. As policy is made with an eye for the short, medium or long term, it is very normal to make short, medium or long term adjustments according to the latest developments. Generally speaking, there are two kinds of policies: compulsory and inductive, commonly referred to as carrot and stick approach. The failure of policy will also incur social costs, which are lower than legal intervention and executive order. In fact, one of characteristics of effective market supply is its “resilience”. Resilient demand and resilient supply are concrete indexes of market adjustment. Therefore, the SAR Government can adopt the “policy → executive order → legislation” approach to intervene.

IV. Conclusion

The definition of optimization goal for Macao’s industrial structure and analysis of choice of path can serve to promote moderate diversification of Macao’s economy. First, the definition of macro, meso and micro optimization goal can help the academic circle gain insight into what “development goal of moderate diversification” fails to elaborate clearly. The conclusion reached by this paper is that optimization goal is not equal to the goal of moderate diversification. However, with its theoretic system and quantification basis, optimization goal aims to reach the development standards of rationalization and supererogation, which are closer to the goal of moderate diversification. Second, by analyzing the shift from capital-intensive to knowledge-intensive model, the decreased ratio between the output values of secondary and tertiary sectors, and the choice of path for effective market supply, the paper makes a comprehensive proposal for each optimization reasoning in such dimensions as market, industrial policy and institutions, breaking away from the narrow-minded thoughts that have been long cherished by the academic circle on vertical- and horizontal-diversification frameworks so as to facilitate the real practice of moderate diversification by Macao. Finally, it is theoretically believed that the SAR Government can increase the proportion of secondary sector’s output value and decrease the ratio between the output values of secondary and tertiary sectors as long as it applies the industrial structure optimization theory, ensures effective market supply and grasps the development opportunities offered by high technologies related to electrical vehicles, TCM (biotechnology), 3D printing. Meanwhile, by making full use of institutional advantages of “one country, two systems” and “comparative advantage” of ample

government finance, sticking to reform and opening up, effectively allocating resources and drawing up policies and programs, Macao can make the shift from capital-intensive to knowledge-intensive development.

Notes:

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- ⁵ Hisrich, R. D., M. P. Peters and D. A. Shepherd (2013). *Entrepreneurship*. New York: McGraw-Hill.
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- ⁷ National development fund is mainly invested in national key projects.