The Analysis of Economic Growth Cycle in Henan Province

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Abstract   According to the data of practical GDP time sequences from 1978 to 2009 provided by *Henan Statistical Yearbook* of every year，Hodrick-Prescott filter model is established，and it is disintegrated into tendency component（potential yield）and fluctuation component（yield gap）. The critical division loci of filter model are 4 wave crest years（1980，1988，1996 and 2007），and 3 trough years（1984，1992 and 2002）. Thus since the opening up and reform，the economic growth fluctuation of Henan can be divided into 3 complete cycles and 2 incomplete cycles. Based on the economic situation and background within and without province，we preliminarily conclude the stage-characteristics of all growth cycles and the probable reasons of fluctuation. On the whole，the economic growth cycle of Henan takes on astringency to some extent，and sustainability and stability are reinforced，showing the characteristics of growth-type cycle increasingly.

Key words   Economic cycle，Hodrick-Prescott filter method，Economic growth，Henan，China

As of 2010，Henan's GDP has ranked NO. 5 for 11 years smoothly in China. In the process of long-term development，Henan's economy once underwent periodic fluctuation many times，which played negative role in economic development. Only by the deep research on period of end and occurrence，stage characteristics and profound reason of economic growth cycle in Henan Province can we speak or act with a well-defined objective in mind in order to use all kinds of regulation instruments to allay or counteract the negative impact，and keep sustainable，rapid and healthy development region. Most of traditional methods divide economic cycle based on inflection point of growth speed. Currently，we mainly use statistical method to decompose index variables into component of tendency and cycle，including three types：multi-variables method[1-4]，production function method and single-variable method[6-9]. On the whole，the multi-variables method and production function method have high requirement on quantity and quality of data. It is just what the provincial level data universally lack，so in the empirical analysis，the single-variable method is applied universally. The effect of BP spectral method in the single-variable method hinges on whether the selected value of filter coefficient is appropriate[10]，which often makes it difficult to conduct the practical modeling；while the wavelet denoising method and threshold auto-regressive method is too complicated with little interpretability. Being that Hodrick-Prescott（HP）filter method has strong adaptability to non-stationary time sequence，so it has been applied extensively since the late 20th century. According to the availability and applicability of data and practical characteristics of Henan Province，I use HP filter method to quantitatively measure the potential output and gap of output of Henan Province.

1   Research method and data source

1.1   Hodrick-Prescott filter model   HP filter regards the fluctuation cycle as the deflection from a slow path. This path，taking on non-linear monotonous increase in the entire sample period，is called long-term tendency. The tendency component can be estimated by minimization of value，namely the tendency value of time sequence and sample point as follows：

$$\pi = \min_{X_t, t=1,2,\cdots,T} \left\{ \sum_{t=1}^{T}(Y_t - X_t)^2 + \lambda \cdot [(X_{t+1} - X_t) - (X_t - X_{t-1})]^2 \right\} \tag{1}$$

In the formula，X_t is the tendency component in time sequence Y_t；filter coefficient λ is punishment factor，which determines smoothness degree of tendency component and its tracing degree on practical sequence. The second-order difference item $\Delta^2 X_t$ is the variation of tendency component growth rate ΔX_t；$C_t = Y_t - X_t$ is cycle component；we assume C_t and $\Delta^2_{X_t}$ independent and in normal distribution，when $\lambda = \mathrm{var}(C_t)/\mathrm{var}(\Delta^2 X_t)$，then HP filter can obtain the optimum result[11]. So we can get tendency component X_t and cycle component C_t respectively as follows：

$$X_t = [1 + \lambda \cdot (1 - L^2)^2 \cdot (1 - L^{-1})^2] \times Y_t \tag{2}$$

$$C_t = \frac{\lambda \cdot (1 - L^2)^2 \cdot (1 - L^{-1})^2]}{1 + \lambda \cdot (1 - L^2)^2 \cdot (1 - L^{-1})^2]} \times Y_t \tag{3}$$

In the formula，L is unit-delay operator. At the present time，the academic world has certain divergence about the value of coefficient λ. When using the year data，Hodrick&Prescott and Backus&Kehoe both suggest the value of 100，OECD suggests the value of 25，Ravn&Uhlig and the Macro Economic Regulation Seminar of Chinese Academy of Social Sciences suggests the value of 6.25[3]. This research determines the value as 6.25 according to the updated research results.

1.2 Data source and processing   The regional total output value is adopted to be as the proxy variable of economic developmental level. From *Henan Statistical Yearbook* every year[12], we put the price in the year as time sequence of GDP, and unit as 0,1 billion yuan; use fixed base GDP index to conduct reduction conversion in order to get the practical GDP over the years which takes the year 2005 as base period (GDP_{05}); the time limit is from 1978 to 2009.

2   Results and analysis

2.1   Analysis of economic growth tendency   Fig. 1 reports the line chart of GDP time sequence, the first-order difference time sequence ΔGDP and the second-order time sequence $\Delta^2 GDP$. Since reform and opening-up, Henan's GDP has taken on prominent stile-type growth characteristic and prominent stage variation characteristics in different historical periods. Prior to the early stage of the 1980s, it increases rapidly but then it is mired in stagnation over the years; then in the late 1980s, it increases again with rapid speed, which is the prime time of Henan economic growth in history and it peaks in the middle 1990s; after it stagnates for 6 years due to the impact of Asian financial crisis, and it even slumps; after 2003, it develops again with prominently rapid speed, but falls due to the impact of global financial crisis in 2009.
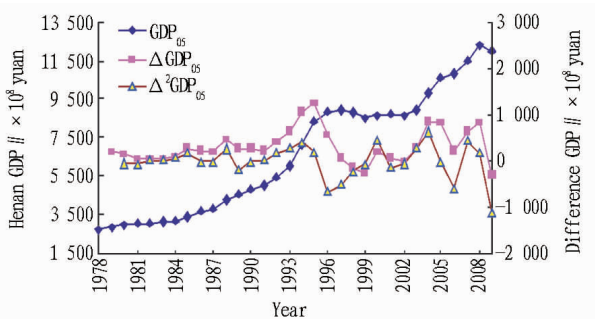

Fig. 1   GDP and difference time-order broken line from 1978 to 2009

2.2   Tendency component and fluctuation component
Fig. 2 reports the tendency component after we filter time sequence, and there is great difference of growth rate in different historical stages. Prior to the late 1980s, it grows slowly; in the middle 1990s, it develops rapidly, but then it is mired in stagnation and until recent years it begins to develop rapidly. In comparison with Fig. 1, we can find that the time sequence after we filter short-term high frequency fluctuation component is very smooth.

In the theory of economic fluctuation cycle, we call the long-term tendency component of GDP potential output, while we call the difference of practical GDP and potential output gap. The output gap is the basis for judging economic cycle. In order to observe the detailed tendency of economic cycle, it needs to eliminate the impact of dimension, transforms the absolute value of output gap into deflection percentage of relative long-term tendency value.
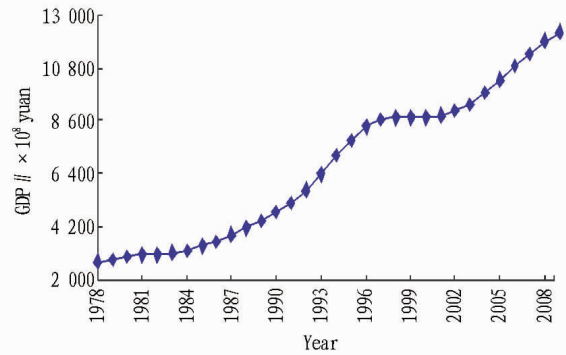
Fig. 3 reports the short-term fluctuation component after

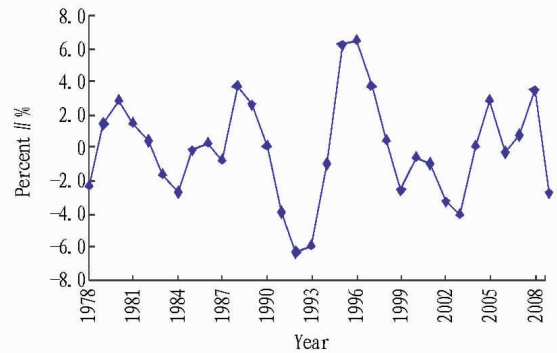**Fig. 2   The long-term trend component of GDP from 1978 to 2009**

Fig. 3   The short-term fluctuation component

filtering, taking on irregular variation characteristics. We can clearly find that in three decades, the overall crest and trough of economic growth are in 1996 and 1992 respectively. In addition, there is local crest in 1980, 1988, 2005 and 2008, and there is local trough in 1984, 1987, 1999, 2003 and 2006 respectively. We also clearly find that Henan's economy in 2009 was in downturn prominently.

2.3   Cycle analysis of Henan's economic growth fluctuation   By the fluctuation component change tendency in Fig. 3, it is still difficult for us to precisely determine the time of beginning and ending of all fluctuation cycles and stage characteristics. We can adopt the second filter method to aid judgment. That is to say, we conduct second time HP filter on the cycle component after filtering. Fig. 4 reports the corresponding filter results.
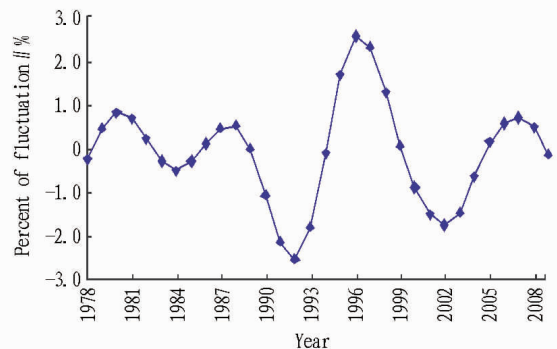

Fig. 4   The growth fluctuation cycle of GDP in Henan

Obviously, the corresponding crucial positions of dividing line regarding Henan's economic growth cycle are the four crest years, namely 1980, 1988, 1996 and 2007, and the three trough years, namely 1984, 1992 and 2002. According to the usual classification way of "crest-crest" economic cycle, since reform and opening-up, Henan's economic growth fluctuation can be classified as 3 complete cycles and 2 incomplete cycles.

2.3.1 Classification of economic growth cycle and stage characteristics. The years 1978 – 1980 are the first incomplete cycle. Reform is initiated firstly in rural areas, which greatly motivates farmers in the production activities. The city conducts the reform and exploration of comprehensive economic system; carries out the demonstration point work of enlarging enterprise autonomous right; expands the investment scale; optimizes and adjusts the industrial structure; rapidly changes the retrogressive and stagnant industrial development in whole province.

2.3.1.1 The first growth cycle (1981 – 1988). At the initial stage of reform and opening-up, under the direction of thought of "work hard and strenuously", many programs which were not equipped with basic conditions were carried out blindly at the same time, so that the construction scale peaked rapidly and it gradually evolved into blind "unrealistic leap". Henan implements the guideline of "adjust, reform, neaten and promote", and suspends a batch of programs. In the period of the Sixth Five-year Plan, under the circumstance that the theory of planned commercial economy" makes breakthrough, it begins to popularize "dual system" of price. In order to meet the need of development level of productivity at the preliminary stage of socialism, the shackles and restrictions of non-public ownership of means of production are shattered, and the town enterprises emerge. Since 1985, the provincial economy has been at the rapid-increase stage. The outstanding characteristics of Henan's economic growth cycle in this period: there is no high-speed growth and sharp recession; the economic fluctuation moderates in comparison with that before, fluctuating around potential growth rate within a reasonable range including top limit and bottom limit; the potential difference of crest and trough is smaller than that in other cycles; the annual average growth rate in cycle is relatively high among all cycles. Even if it is in the trough of cycle in this period, Henan's GDP can work smoothly and the growth rate falls temporarily with no outstanding minus gap. The nature of fluctuation in this period is the typical growth type, different from the traditional classic type of other cycles. This indicates that in the micro economic scope, introducing the market allocation way of resources has a certain advantage. Henan gets rid of the disadvantage of sharp rise and sharp fall under the traditional planned system gradually and realizes the stable and continuous development of economy.

2.3.1.2 The second growth cycle (1989 – 1996). Under the direction of blind optimism and anxiousness for success from top to bottom, there are inflated investment and consumption; the contradiction between supply and demand, accumulation and consumption becomes acute again in the new form; the bottleneck restriction of infrastructure and elemental industries become increasingly outstanding; high inflation forces the government to conduct governance in the late 1980s and the economic growth rate falls sharply in a short time. In 1992, the reform direction of socialist market economy was determined formally. As the thought of "developing industry based on agriculture and developing industry to promote agriculture" is proposed, it symbolizes the further crystallization of objective model of industrialization, urbanization and agricultural modernization in Henan. Balancing economic aggregate, optimizing structure, developing agriculture and strengthening construction of infrastructure become the key strategy of whole province, and the strategic guidelines are implemented one after another, such as "one high and one low", "sustainable development", "relying on science and education to rejuvenate Henan", "developing and leading" and so on. The characteristic economic developmental strategy of Henan gradually tends to be mature. Taking tax-sharing reform as a symbol, it forms characteristic economic decentralization of authority and political centralization of authority system, and the local governments have unprecedented enthusiasm of construction[13]. Under the guidance of various kinds reform measures, Henan's economy develops rapidly.

Being that the experience of governmental regulation is still in increasing grope and accumulation, Henan's economy in this cycle has the phenomenon of violent jarring, and fails to sustain the characteristics of low amplitude of vibration and high growth rate of the preceding cycle. In the late 1980s, hard landing exerted great reverse onslaught on regional economy, resulting in the sharp reversed situation; after Deng Xiaoping made his Southern Tour, the investment scale was rapidly expanded and Henan's economy was sharply revived rapidly. The outstanding characteristics of this cycle is that there is great economic fluctuation; no matter how fast it rises or no matter how fast it falls, it is most prominent among all cycles. It also indicates that the interaction between blindness existing in market economy and incomplete regulation means under particular historical conditions increases the possibility of sharp fluctuation of regional economy.

2.3.1.3 The third growth cycle (1997 – 2007). From 1996, bubble economy appeared and the financial order was in chaos. Taking soft landing as crucial point, the operation environment of Henan's economy changes prominently, the era of "shortage economy" ends, and buyer market basically forms. The reform of economic system is at a crucial stage. The outburst of Asian financial crisis directly causes the outstanding deterioration of international trade situation, and Henan's economy steps into the five-year period of shrinkage and adjustment. In the 21st century, Henan correctly deals with the relationship between national macro regulation and local economic development, so as to fundamentally avoid the disadvantage of being accustomed to the national macro regulation passively. Henan puts the corporate system of state-owned enterprise and multiplex reform of property rights structure as point of strength; vigorously implements the strategy of central city providing impetus; grasps the great historical opportunity of rise of

central China to actively undertake the industrial transfer at home and abroad, and focus on fostering 6 advantageous industries, namely food, colored metal, chemical industry, automobile and the parts, and textile. It basically entrenches the status of emergent industrial big province. In 2002, Henan stepped into the middle-term stage of industrialization; the industrial added value from 2001 to 2008 annually increased by 15.9%, 2.9 percentage points faster than the previous period[14].

The outstanding characteristic of this period is critical asymmetry of rise stage and fall stage. Usually, the growth extent and duration in one cycle at the stage of rise should be greater than that at stage of fall. In the cycle, not only the biggest range of decline at the stage of fall are greater than the biggest range of rise at the stage of rise, but also the long duration of the stage of fall is most outstanding among all cycles. The main reason lies in that the internal adjustment need of inhibiting domestic economic overheating and arresting inflation overlaps the external onslaught effect of Asian financial crisis. We also should find that even if it is impacted by the complicated internal and external disadvantageous factors, the reverse output gap is smaller than the gap in the period " hard landing", late 1980s, which indicates that the level and effect of governmental regulation policy are conspicuously promoted. Especially in the late period at the stage of rise in this cycle, Henan's economy does not grow sharply, but takes on the typical characteristic of stability.

2.3.1.4   The current growth cycle (2008 –). The economic growth for many years finally makes the cost of labor forces, exchange rate and resources factors increase incessantly. Henan is in the face of profound transformation of developmental model. Influenced by the accumulation effect of policies, at the end of 2007, the economic growth peaked and the middle and long-term adjustment initially loomed large. The subprime crisis from America in 2006 evolves into the vicious cycle of interaction of global financial crisis and recession of real economy and interaction of the countries in the centre of crisis and the countries in the periphery. The periodic adjustment of domestic economy after long-term rapid growth since the reform and opening-up overlaps the global financial crisis and the economic recession in the world. As the need at home and abroad bears brunt, so it is necessary to enlarge the depth of economic revert and duration. Although the government implements the active financial policy and moderate loose currency policy timely and formulates a series of countermeasures, such as increasing large-scale investment, expanding the credit scale acutely and home appliances going to the countryside, the domestic demand of market dominance lacks powerful support, and Henan's economic growth took on tendency of slump in 2008 due to lag of policy effect. Theoretically, currently it is at the stage of shrinkage in this cycle. As of the second quarter of the year 2009, part of the dominant industries and part of the dominant indices began to take on the sign of instability. There is uncertainty to some extent in the future regarding when Henan's economy begins to revive actually.

2.3.2   Fluctuation characteristics of all growth cycles. Accord-

ing the previous two fluctuation cycles, it is not hard for us to find that the height of fluctuation tends to rise increasingly, while the depth of fluctuation tends to fall. This indicates that the increase of fluctuation amplitude gradually transits from medium-wave cycle (wave amplitude is 5 percentage points) to strong-wave cycle (wave amplitude is 10 percentage points). This is not beneficial to macro economic stability obviously. The main reason lies in that along with the further development of reform and opening-up, Henan has close relationship with the world and the external risk prominently increases in the process of economic development. Certainly, the excessive worry is unnecessary. If we put aside the impact of Asian financial crisis, the wave amplitude of Henan's economic growth will greatly dwindles. Since the new century, the regulation means of government have been perfected day by day. The growth curve of Henan's economy gradually becomes smooth and the amplitude shrinks. Meanwhile, the crest falls and the trough rises; economic cycle tends to be smooth and fine, and fluctuates slightly around the potential growth rate, taking on astringency. Not only the phenomenon of great fluctuation of " high crest and deep trough" is conquered, but also it takes on the characteristics of growth-type cycle. On the whole, the length of fluctuation and expansion of current growth cycle is longer than that of the previous period (the period of rise from 2003 keeps 5 years successfully), and the duration is unprecedented. The duration of all growth cycles is basically keeps stable, and tends to extend slightly, which transits from the former short cycle to middle cycle. It initially indicates that the sustainability of Henan's economy is increasingly strengthened. However, this kind of relations are still instable, yet to be further observed.

3   Conclusion and discussion

The geographic characteristic of Henan in hinterland determines that the dependency on export-oriented economic growth model of costal regions is limited, so it bears little negative brunt of global financial crisis. On the contrary, Henan is the important big province of population and agriculture in China. In the process of rapid propulsion of urbanization and industrialization, it has large-scale regional urban-rural consumption market. In addition, residents' consumption focuses on real estate and cars, which is at the upgrade stage of structure and has great potential for long-term growth. At the present time, the decelerated Henan's economic development is caused by the normal adjustment after rapid growth over the years. From now on, the key of long-term and stable growth of Henan's economy is that we should effectively transform the traditional growth model; radically rectify imbalance of on the structure of " high savings and low consumption" excessively dependent on investment drive; put the regional economic policy of " domestic demand is dominant and consumption is basis" as point of strength; increasingly strengthen and improve the economic regulation measures; fully coordinate the relationship between long-term growth tendency and short-term periodic fluctuation of economy. The global financial crisis may create the historical opportunity to change this situation.

keep the stability of sugar price[16].

4.5 Quickening the transformation from savings to investment and evade "resource curse" High saving ratio is the primary economic condition for evading "resource curse". Obsession of "resource curse" and PPE circle can be ridded with relatively high saving ratio and especially the increase of saving ratio beyond resource benefit has great significance in evading "resource curse". Another key factor that can not be neglected is that the high-efficient transformation from saving to investment or transformation from resource benefit to production-oriented investment is the primary means of evading curse and achieving economic growth. The growing impact of human capital and continued ability of technical innovation are crucial obstacles in controlling "resource curse". Educational system in resource-rich area should be promoted to introduce resources into education and scientific research and establish excellent scientific research center. Besides, experts and scholars should be encouraged to conduct overseas mission and the cluster brand will be more stable once the education and research development investment and infrastructure are completed[17].

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Henan should pay attention to optimization of structure and elevation of competitiveness in order to quicken the process of industrialization; focus on balanced development of regions so as to promote urbanization; focus on comprehensive rural reform so as to promote the agricultural modernization; focus on reform of resources price in order to promote social development; emphasize the guarantee of people's livelihood and construction of harmonious central plains of China in order to promote the government management system reform comprehensively and reform of social undertaking, and promote Henan's economy successfully to be at the stage of rise in the new economic cycle.

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