

# ISSUES AND FACTS ON DEVELOPMENT

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## The Current Issue:

*Lucas, Tolstoy, and Development*

By Pedro Conceição

Growth models are intellectually fascinating. They provide powerful insights into the broad determinants of development. But their usefulness for designing concrete development policy may be limited. The reason why has a little to do with something that was recognized by Tolstoy.

## Facts at a Glance:

*Microscoping China's CPI Inflation*

By Yanchun Zhang

China's creeping inflation is catching the world's attention. Is it due to the increased demand or the excess money? Is it fair to blame China for the run-up in international food prices? These questions are easy to raise but hard to answer. Let's first put China's CPI inflation data under a microscope and take a closer look.

## About

### *Issues and Facts on Development*

*Issues and Facts on Development* is a brief issued by the Office of Development Studies (ODS), United Nations Development Programme. The new publication takes on up-to-date topics in the area of development and shows them in a new light. It consists of a main feature titled "the current issue" and a number of mini features headed "facts at a glance".

For inquiries on how to receive this brief regularly or to contact the authors, please send an email to [ods@undp.org](mailto:ods@undp.org)

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## THE CURRENT ISSUE

### Lucas, Tolstoy, and Development

By Pedro Conceição

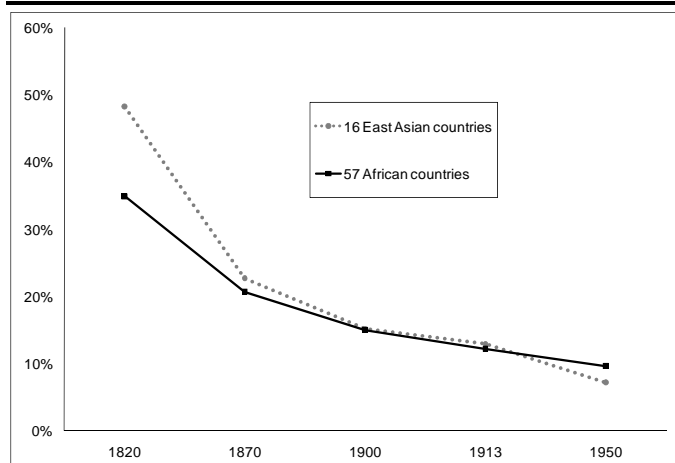
The contours of the long-term evolution of the global economy, as Angus Maddison put it, are well known. For millennia humanity lived on about US\$600 per person per year. Then in the 19<sup>th</sup> century world income per capita started to increase rapidly. It more than doubled in 80 years from 1820 to 1900. It then increased further more than five-fold in the 20<sup>th</sup> century. This unprecedented expansion of income per capita went along with a sharp increase in inequality across countries. Up to the 18<sup>th</sup> century income per capita was roughly the same across different regions. By 1820 the richest countries had become three times wealthier than the poorest. This ratio increased relentlessly ever since, to 6 by 1900 and to about 18 at the outset of the 21<sup>st</sup> century.

The industrial revolution in about 1820 and the shift towards industrial economies was the trigger for what Kuznets called “modern economy growth”. But why did the industrial revolution take place at all? Historians continue to debate this question. Some economic models, too numerous to review in detail, but including several proposed by Michael Kremer, Chad Jones, and Oded Galor, amongst others, have also put forward theories. The most compelling formalize the intuition that two factors interacted to make the industrial revolution happen. First, since more people interacting more are more likely to generate new ideas, population and urbanization levels had to reach certain critical thresholds. The second factor was the establishment of conditions that enabled the extraction of economic value from new ideas, along with “institutions,” as defined by Douglass North, that encouraged productive investment and efficient exchange.

A related question is why the industrial revolution took place where it did, and not somewhere else. Joel Mokyr, David Landes, and Kenneth Pomeranz have joined historians and others in addressing this question. In addition to sufficiently high levels of urban population and incentives to generate and utilize new ideas, access to natural resources from the “new world” appears to have played a critical role in enabling the UK to take the lead. Other Western European countries (many also with access to resources from colonies) followed quickly, along with what Maddison has called Western Offshoots (Australia, Canada, New Zealand, and the US).

In the century that followed the first signs of the industrial revolution, large parts of humanity became more and more separated from the income levels of the Western Offshoots and Western Europe (Chart 1). Africa was already three times poorer than the Western Offshoots in 1820 and by 1950 it had barely 10 percent of their income per capita. A group of 16 East Asian countries (including Japan, China, India, the Philippines, Malaysia, Indonesia, Thailand, and the Rep. of Korea) representing a large share of the world’s population had about half of the income per capita of the richest countries in 1820, but less than 7 percent by 1950.

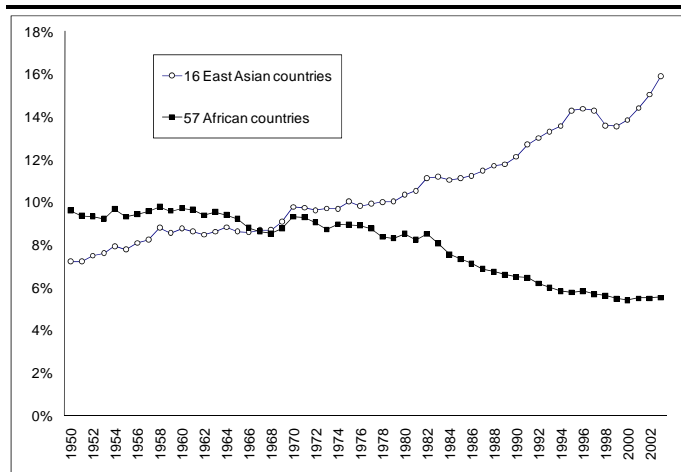
Chart 1  
GDP per Capita of 16 East Asian and of 57 African Countries as a Percentage of Western Offshoots, 1820-1950



Source: Own calculations based on Maddison (2007).

Since 1950, the evolution of GDP per capita was drastically different. While the East Asian countries converged towards the average income of the richest countries, Africa continued to diverge (Chart 2). One plausible hypothesis to explain this disparity in economic performance is the following: perhaps the industrial revolution diffused to some places but not to others. “Industrial revolution” here means much more than the technologies that unleashed the process in the 19<sup>th</sup> century. It encompasses the ideas, innovations, and forms of economic and social organization that drove “modern economic growth” in Western Europe and in the Western Offshoots.

Chart 2  
**GDP per Capita of 16 East Asian and of 57 African Countries as a Percentage of Western Offshoots, 1950-2003**



Source: Own calculations based on Maddison (2007).

In a recent paper Robert Lucas (2007) formalizes in a new and different way this hypothesis. His model assumes that there are two groups of countries. One group contains the early adopters and continuing leaders of modern economic growth. In this group, growth in income per capita is proportional to the per capita stock of knowledge ( $H$ ) that drives production. In the spirit of (a class of) endogenous growth models that Lucas pioneered in the mid 1980s, along with Paul Romer, income per capita is entirely driven by this “knowledge capital,” which, unlike physical capital, does not exhibit diminishing returns and is assumed to grow at a constant rate,  $\mu$ .

Then there is a second group of countries that contains the late adopters of the industrial revolution. In the model, rather than coming up with their own industrial revolution, the follower countries grow (at a rate  $g$ , higher than  $\mu$ ) because their stock of knowledge per capita ( $h$ ) increases as knowledge flows from the leader countries. The model predicts that the further behind a follower country is the more rapid it is likely to grow. In addition to the “distance to the frontier,” the growth rate of follower countries depends on a parameter,  $\theta$ , which measures the strength and scope of the knowledge spillovers from the leaders to the followers.

The equation that expresses the GDP per capita growth rate of the followers at time  $t$  is given below this paragraph. A value of  $\theta$  that is close to zero would mean little knowledge spillovers, and consequently the growth rate of the followers would be close to that of the leaders – no catch-up. As  $\theta$  increases to one (the maximum value the

parameter can take) then all the knowledge that the leaders have spills over to the followers, and the growth rate of the followers is amplified by the ratio that measures distance in terms of knowledge stock to the leaders – there is catch-up until the stock of knowledge of the followers reaches the same level of the leaders. From that point on, the previously follower grows at the same rate as the countries at the frontier.

$$g(t) = \theta \left[ \frac{H(t)}{h(t)} \right]^{\theta}$$

This is an extremely powerful and simple model because the dynamics depend essentially on the single parameter  $\theta$ . Can it really be the case that the dynamics of the diffusion of the industrial revolution is explained by one number? Not quite, but close. Not quite because knowledge cannot flow to countries that are not open. Open here in a broad and loose sense, of allowing for a reasonable free flow of ideas, people, commodities and finance. This should not be confused with the narrower and stricter concepts of openness to trade or capital flows that are often hotly debated in the literature. For example, trade openness, as measured by exports plus imports as a share of GDP, can be highly misleading in this context. A country that is a large oil exporter can show a high level of trade openness and at the same time be rather closed for the purposes that matter for the discussion here.

The evidence presented by Lucas in his paper is rather compelling. The model does describe well the catch-up dynamics of a large set of open countries (more on why it does not describe the dynamics for *all* open countries later). There is no point replicating the analysis in the paper, so an alternative way of “testing” the model is proposed here, relying on the indicator that we have been using: GDP per capita of the followers as a percentage of the leaders. The analysis will be for the period 1950 to 2003. Assuming a constant growth rate for the followers,  $\bar{g}$ , then the evolution of the ratio of GDP per capita of the followers as a percentage of the leaders predicted by the Lucas model is, trivially, given by the expression below.

$$r(t) = \frac{h_{1950}}{H_{1950}} \bar{g}^{[g(t)-\mu]t}$$

The Western Offshoots are taken as the group of countries that contains the leaders, and  $\mu$  is taken as 2 percent a year – consistent with the yearly GDP per capita growth rate of the Western Offshoots over the long run, also the value used by Lucas. As the group of followers, we take four out of the 16 Asian economies considered earlier that can be

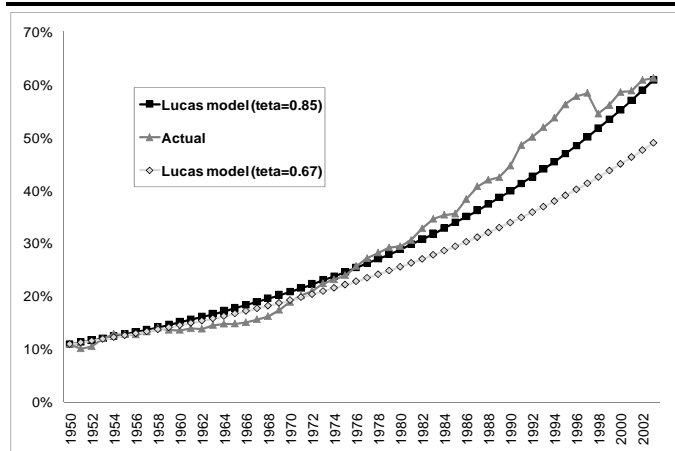
classified as open: Rep. of Korea, Taiwan, Hong Kong (SAR), and Singapore. Some of the other economies cannot be considered open throughout the entire period, Japan was already “too rich,” and other economies, though open, are too poor to be explained by this model (more on this later, we will get there...). The ratio between the followers and the leaders of the stock of knowledge in 1950 is taken to be equal to the ratio of GDP per capita in that year: 11 percent.

All we need is an explicit formula for the average growth rate of the followers. From what has been explained about the model, it is intuitive that this average growth rate will depend only on the initial knowledge stock gap (which we have taken to be 11 percent) and on the spillover parameter  $\theta$ . The algebra is a bit cumbersome, so the explicit expression is made available below for aficionados (in the expression,  $T$  equals 53, which is the number of years that we are considering in the analysis and averaging growth rates over).

$$g(\theta) = \frac{1}{T} \log \frac{H_{1950} e^{\theta T} \left\{ 1 - \left[ 1 - \left( \frac{H_{1950}}{H_{1950}} \right)^\theta e^{-\theta T} \right] \right\}^{\frac{1}{\theta}}}{h_{1950}}$$

Chart 3 shows the actual evolution of the income per capita ratio between the followers and the leaders. It increased 50 percentage points, from 11 percent in 1950 to 61 percent in 2003. The collapse created by the Asian financial crises in 1997-1998 is clearly visible. Growth spurts and periods of relative slower growth are also apparent. But we are interested here only in the long-run trend, which is what growth models aim at capturing. How well does the Lucas model do? Chart 3 also shows the predicted evolution of the ratio using two parameterizations for  $\theta$ . If we use the preferred choice of Lucas of 2/3 for  $\theta$  (which fits best his analysis in the paper of a larger group of countries over longer periods of time), we can see that these economies did much better than expected from the model. However, if our own parameterization of 0.85 for  $\theta$  is used, the fit is very good. This is admittedly a high value for a spillover parameter, but appears to be consistent with the experience of these four economies. Either spillovers were much deeper and wider for these countries than they are on average for all countries (our choice of the parameter) or they were able to consistently grow above “potential” for more than half a century.

Chart 3  
GDP per Capita of 4 East Asian “Open” Economies as a Percentage of Western Offshoots, 1950-2003



Source: Own calculations based on Maddison (2007); own parameterization of the Lucas (2007) model.

Obviously, both explanations are possible, and the point here is not to come to a final determination on what is the one right answer given those two possibilities – although the fact that the model is not able to address this question is telling about the practical limit of growth theory to help with policy. Rather, the objective is to illustrate how Lucas’ simple, one parameter, model can indeed explain the diffusion of the industrial revolution to some open economies. But why not all?

Lucas shows that his simple one parameter model can only describe the growth dynamics of countries that are already relatively advanced. The intuition is that knowledge cannot diffuse, no matter how open a country is, to a society that is mainly agrarian and with very low levels of human capital. To take his model further, he develops a dual economy set-up in which the transition to an industrial society is influenced not only by the spillover parameter. The share of employment in agriculture is taken as a proxy for the lack of conditions to enable knowledge absorption. Factors related to the knowledge spillovers linked to increased urbanization need to be taken into consideration. So the number of parameters increases from one to five. We are almost back to the models mentioned earlier that seek to explain the outbreak of the industrial revolution, with some of the same factors (thresholds in urbanization and people engaged in activities other than agriculture) coming into play. The difference is that with Lucas we are still within a catch-up and knowledge spillover framework. This more complicated model does describe the dynamics of those open, poorer economies that converged, but at a slower rate, like Thailand, Malaysia, Indonesia, and Sri Lanka.

While the model is very good at interpreting convergence by open economies, it has nothing to say about why the 57 African countries diverged. Perhaps the best way of interpreting the Lucas model, as he suggests, is as giving an indication of “potential” growth rates by open economies that were reasonably shielded from major shocks, persistent incentive-distorting institutions (as explored by Daron Acemoglu, Dani Rodrik, and others), volatile and harmful policies, and other detrimental factors (adverse geography or disease, as emphasized by Jeffrey Sachs and others). For example, as noted in *Issues and Facts on Development 2*, conflict can derange economic performance for decades. Chart 3 shows that the Asian financial crisis also had a big effect on the growth path of the four Asian countries we have been considering – and that in fact, despite the acceleration in growth that followed the crisis, these countries may have not yet returned to the growth path they would have been in absent the crisis.

Which brings us to Tolstoy. In *Anna Karenina* he famously said that all happy families are alike, but each unhappy family is unhappy in its own way (this is translated to English from memory based on a reading in Portuguese of the book a long time ago, so it may not be entirely accurate). Perhaps the same, in a sense, when it comes to countries and development. All converging countries may be more or less fundamentally alike, at least so alike one another that convergence can be described by very simple models. This is important, because it gives us some sense of a “benchmark” or, at least, of potential. However, this is not enough to explain why some countries grow above potential – which is one possible interpretation of the experience of the four converging Asian countries. The model does not discriminate between growth above potential – which is not explained by the model – or parameter heterogeneity – which is a problem for the universal validity of the model.

But even more troublesome, the model says nothing about the countries that did not do that well. The model is lacking as an explanation for divergence. Perhaps because each divergent country may be so in its own way. And this is why it is so important to really understand deeply the factors that constrain convergence, growth, and development in each and every country that keeps falling behind. Either that, or prove that the Tolstoy analogy does not hold and it is indeed possible to write a general model of divergence. Until then, we can look at growth models to give us an indication of potential growth, but the direct implications for policy are only useful at a very general level.

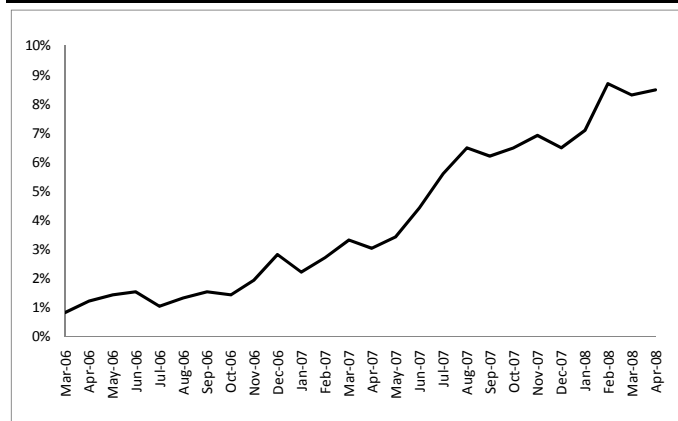
## FACTS AT A GLANCE

### Microscoping China's CPI Inflation

By Yanchun Zhang

Inflation in China has been rising, and rising fast (Chart 1). The year-on-year CPI inflation rate has jumped from less than 1 percent two years ago to more than 8 percent today. For the first four months of 2008, the consumer prices increased by 7.1 percent, 8.7 percent, 8.3 percent, and 8.5 percent respectively. The problem with these year-on-year numbers is that they smooth out the sharp monthly price fluctuation.

Chart 1  
China's Y-o-Y CPI Inflation (March 06 – April 08)



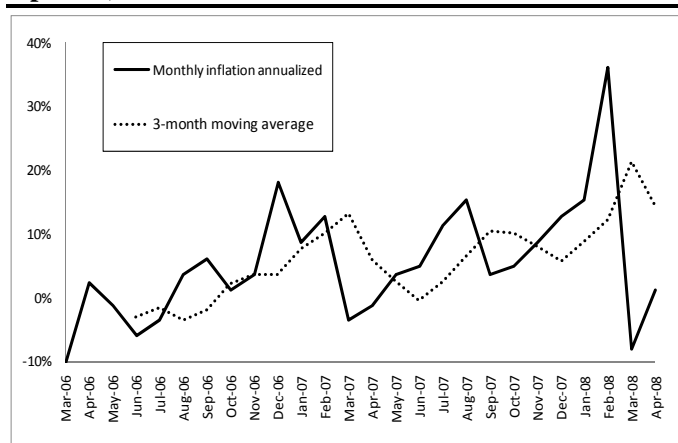
Source: National Bureau of Statistics of China.

The annualized monthly inflation rate, which is comparable to the U.S. CPI inflation data released by BLS, will help to identify the early signs of inflation. But even though the National Bureau of Statistics of China releases the consumer price inflation data every month, it does not report the CPI index. All that it releases are the year-on-year and month-on-month changes in the CPI index.

We use the published month-on-month consumer price inflation data to derive backward a monthly China CPI index series (which approximates the released year-on-year consumer price inflation data pretty well) and then compute China's annualized monthly inflation rate for the past two years. Chart 2 shows that China's inflation<sup>1</sup> has started to rise in the fall of 2006 based on the annualized monthly inflation rate instead of in the middle of 2007 as the year-on-year inflation series shows.

<sup>1</sup> Both the original data series and its 3-month moving average (which tends to lag behind turning points by 2 periods) indicate such.

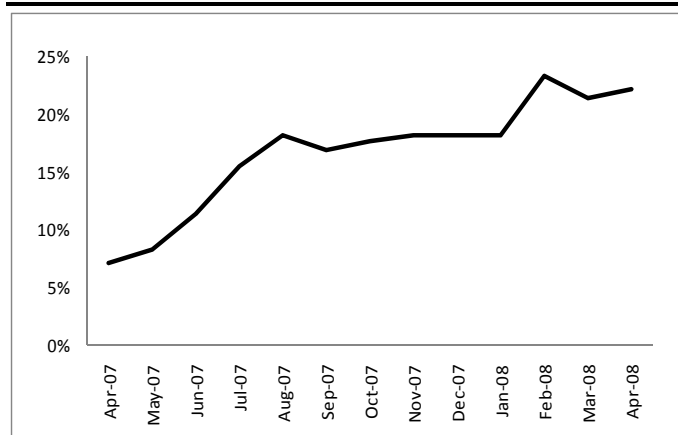
Chart 2  
China's Annualized Monthly CPI Inflation (March 06 – April 08)



Source: Own calculations based on data from National Bureau of Statistics of China.

Taking a look at the price data on 8 categories in the consumer's basket, the price of food items tracked in the CPI is the main culprit of the rapidly climbing inflation in China (Chart 3). It has been reported<sup>2</sup> that food prices rose 12.3 percent and contributed to 85.4 percent of the CPI rise in year 2007 when China's CPI inflation rate jumped to 4.8 percent from the previous year's 1.5 percent.

Chart 3  
China's Y-o-Y Food Price Change (April 07 – April 08)



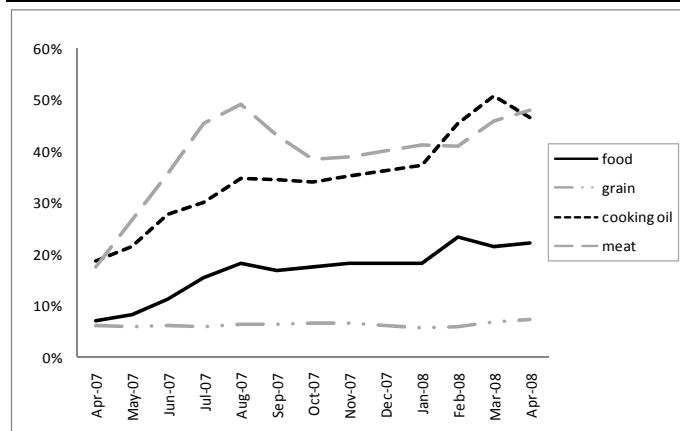
Source: National Bureau of Statistics of China.

<sup>2</sup> Source: <http://english.people.com.cn/90001/90776/6348125.html>

The skyrocketing food prices in China, so far, are neither the cause nor the result of the rising international food prices. The world pork price has not been affected by the domestic price run up in China; China pretty much feeds itself and does not import much grain like rice and wheat; and China is a small exporter of food when you look at its trade data<sup>3</sup>.

We also collected and graphed the prices of food and its three sub-categories: grain, cooking oil and meat to see how the prices of these three Chinese-regarded most important food items have fared. Chart 4 reiterates food prices have been soaring during the course of the past year, especially for meat—pork particularly (not shown in the graph)—and cooking oil. The price of grain, actually, stays at a relative stable level (Chart 5 shows the shooting up grain prices in the international market). China's grain output exceeded 500 million tons in 2007, and the inventory of major farm products including wheat, rice and maize is reported secure and enough to meet domestic market demand<sup>4</sup>.

**Chart 4**  
**China's Y-o-Y Inflation Rate of Food Items (April 07 – April 08)**



Source: National Bureau of Statistics of China.

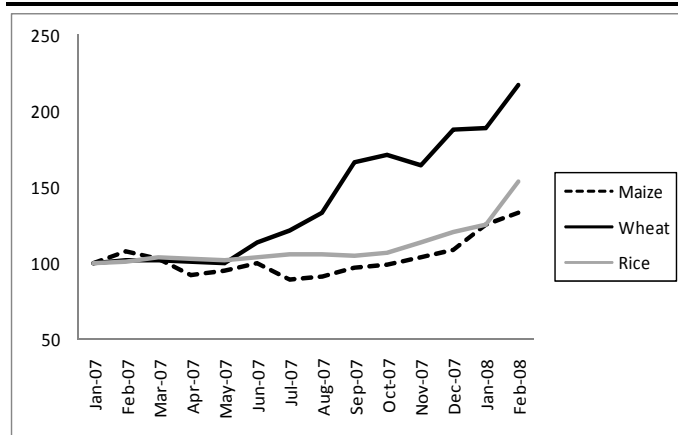
When it comes to what causes the creeping inflation in China, it is not that straightforward. As an increasingly open and important player in the world economy, China inevitably exposed itself (and contributed) to the international price fluctuations. The strong demand for energy and basic materials has transmitted the higher commodity price to China's consumer's basket. But due to its domestic price controls on fuels and a lesser extent of

<sup>3</sup> According to China's Customs statistics, for February of 2008, China's food exports and imports are US\$ 5.17 billion (2.6 percent of total exports) and US\$ 2.08 billion (1.2 percent of its total imports).

<sup>4</sup> Source: <http://ly2.mofcom.gov.cn/aarticle/chinanews/200803/20080305425005.html>

industrial commodity prices' effect on consumer prices, such a pass-through is far from complete.

**Chart 5**  
**Comparison of Maize Price Index, Rice Price Index, and Wheat Price Index (January 07 – February 08)**  
(January 2007=100)



Note: Maize: data from U.S. Gulf Ports; Wheat: data from U.S. Gulf Ports; Rice: data from Thailand (Bangkok).

Source: Own calculations based on International Financial Statistics Online, IMF.

On the supply side, a recent breakout of blue ear disease contributed to the skyrocketing pork price and sent the food price and CPI inflation higher. The unprecedented snowstorm that hit the southern provinces of China earlier this year wrecked crops and disrupted distribution which added to inflation pressure. But economic theory says a supply shock will change the relative prices of goods (e.g. pork will be more expensive, shoes will be cheaper) but will not lead to an inflation which by definition, refers to the overall upward movement in aggregate price level.

So almost naturally we are back to Milton Friedman's diagnosis: Inflation is always and everywhere a monetary phenomenon. Will it be possible that in China simply too much money chases too few goods? We are to leave you some astonishing figures and let you come up with your verdict.

- According to China's State Information Center<sup>5</sup>, the first-quarter speculative inflow exceeded US\$ 80 billion, compared with US\$ 120 billion for all of 2007.
- Massive speculative inflows had driven foreign reserves to a new high. According to the Central Bank (PBOC), China's foreign reserves grew by almost US\$ 154 billion in the first quarter of 2008 and topped US\$

<sup>5</sup> Source: [http://www.chinadaily.com.cn/china/2008-04/14/content\\_6615848.htm](http://www.chinadaily.com.cn/china/2008-04/14/content_6615848.htm)

1.68 trillion at the end of March, up 39.9 percent from a year earlier.

- To tighten domestic money supply and curb inflation, PBOC raised the reserve requirement ratio to a record high of 16 percent in April following a 0.5 percent increase in January and March, on top of 10 such moves in 2007. PBOC also raised interest rates six times in 2007. Each 0.5 percent reserve hike drains about US\$25 billion from the economy<sup>6</sup>, but with foreign reserves growing by about US\$50 billion a month so far this year, China central bank's actions help little to contract the money supply and the aggregate demand.

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<sup>6</sup> Using the year 2007 figure of RMB deposits in the banking system, around US\$36 trillion RMB (see IFS from IMF), a 0.5 percent reserve requirement ratio hike will reduce monetary base by US\$181 billion RMB, and using the end of year 2007 RMB/US\$ rate of 7.3, that is about US\$25 billion.

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### ***Past Issues and Facts on Development***

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#### ***Issues and Facts on Development 2:***

The Current Issue:

*Migration, Remittances and Development*

By Ronald U. Mendoza

Facts at a Glance:

*Post-Conflict Recovery Takes Time*

By Pedro Conceição and Ronald U. Mendoza

*Mega-Sporting Events and Economic Development*

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#### ***Issues and Facts on Development 1:***

The Current Issue:

*Slipping up the Income Ladder*

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Facts at a Glance:

*In Search for Renewable Energy*

By Heloisa Marone and Nina Thelen

*Rising Food Prices and the Inflation Scare*

By Heloisa Marone