When Fast-Growing Economies Slow Down: International Evidence and Implications for China*

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Abstract
Using international data starting in 1957, we construct a sample of cases where fast-growing economies slow down. The evidence suggests that rapidly growing economies slow down significantly, in the sense that the growth rate downshifts by at least 2 percentage points, when their per capita incomes reach around US$ 17,000 in year-2005 constant international prices, a level that China should achieve by or soon after 2015. Among our more provocative findings is that growth slowdowns are more likely in countries that maintain undervalued real exchange rates.

1. Introduction

One of the most important developments affecting humankind in the late 20th and early 21st centuries has been the rapid economic growth of large emerging markets, starting with China, extending now through much of Asia, and experienced increasingly in other parts of the developing world. As Lawrence Summers, former Director of the White House National Economic Council, said, "The dramatic modernization of the Asian economies ranks alongside the Renaissance and the Industrial Revolution as one of the most important developments in economic history." Rapid economic growth, on the order of 10 per-

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cent per annum in the aggregate and close to that in per capita terms has transformed human welfare. Through the miracle of compound interest, it has raised incomes and living standards by an order of magnitude in a generation.[1] The implications extend from the individual to the systemic level. With large emerging markets expanding much faster than the advanced economies, the emerging world has accounted for the majority of the growth of global demand in recent years. The fast growth of emerging markets also means rapid shifts in the relative weight of different regions—East versus West, Asia versus Europe and the United States—something that has geopolitical implications that extend far beyond the narrowly defined economic realm.

That late-developing countries that put a suitable policy framework in place have the capacity to grow more rapidly than early developers is something that economists have known since at least Alexander Gerschenkron.[2] Rather than having to pioneer new technologies, late-developing countries can import knowhow from abroad. They can reap productivity gains simply by shifting workers from underemployment in agriculture to export-oriented manufacturing, where those imported technologies are utilized. With young generations that are presently engaged in saving enjoying higher incomes than elderly dissavers, such countries are able to finance high levels of investment.

But, to invoke that well-known theorist Nelly Furtado, all good things come to an end.[3] Periods of high growth in late-developing economies do not last forever. Eventually the pool of underemployment in rural labor is drained. The share of employment in manufacturing peaks, and growth comes to depend more heavily on the difficult process of raising productivity in the service sector. A larger capital stock means more depreciation, requiring more saving to make this good. As the economy approaches the technological frontier, it must transition from relying on imported technology to indigenous innovation.

Can we say exactly when fast growing economies slow down? Can we say anything about the country characteristics and circumstances on which the timing of the slowdown depends? These questions are the focus of this paper.

1 By a factor of 10 in 25 years.

2 Gerschenkron (1964) emphasized the role of an "ideology of growth" (what we refer to in the text as attaching a priority to successful economic development), state policy, and high investment rates as key ingredients in successful catch-up growth.

3 http://www.youtube.com/watch?v=4pBo-GL9SRg.

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The importance of the answers will be obvious. Significant growth slowdowns in, say, China, India, and Brazil would have a major impact on the global economy at a time when the world depends on these large emerging markets and their smaller brethren for incremental demand. There would be a disproportionate impact on markets for energy and raw materials, given the energy- and raw-material-intensity of economic growth in these economies. There could also be implications for social stability where political legitimacy rests on the success of governments in delivering rapid growth.

Although the implications of our study are by no means limited to a particular country or countries, these issues have special resonance for China, for at least three reasons. First, the country accounts for a substantial fraction of world population. Therefore, the issue of when China slows down will have major implications for the welfare of a significant share of humanity.

In addition, the large and fast-growing Chinese economy is increasingly viewed as a key engine of growth for the world economy. The advanced industrial countries, the traditional engines of global growth, have inherited serious problems from the crisis: weakened household balance sheets, increased public debts, and still troubled financial systems. In contrast, China experienced few problems as a result of the crisis. There were few bank and enterprise failures. At the height of the crisis in 2009, growth "slowed" just to 9.2 percent. Both advanced and developing countries benefited from China's resilience. Robust Chinese demand lifted capital goods exports from Germany and Japan and commodity exports from Africa and Latin America. In particular, demand from China contributed substantially to recovery in East and Southeast Asia, which has close trade linkages with China.

Finally, although China recovered faster than expected from the global crisis, its policymakers are grappling with how to sustain growth in the medium and long terms. The post-crisis external environment is likely to be less benign for a number of reasons. The persistent sluggishness of growth in the advanced countries, which are among China's key export markets, weakens a traditionally important source of demand. The collapse of exports and growth during the global crisis, especially the fourth quarter of 2008 and the first quarter of 2009, highlights the risks of excessive dependence on external demand. This explains why rebalancing growth toward domestic sources of growth has become a priority for Chinese policymakers. And it is not yet clear whether structural adjustment in that direction will be compatible with the maintenance of customary rates of growth. In addition, China faces other medium term structural challenges, notably rapid population aging.

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We know of only a few previous studies that address our central question of when fast-growing countries slow down. Probably the closest cousin to our analysis is Ben-David and Papell (1998). They examine a sample of 74 advanced and developing countries spanning the period 1950–90 and look for statistically significant breaks in time series for GDP growth rates. The vast majority of the break-points they identify are associated with decelerations in growth. They find that these cluster in time. For the industrialized countries many of the structural breaks they identify are centered in the 1970s, whereas for developing countries (Latin American countries in particular) many of the break points they identify occur in the 1980s. They do not, however, utilize criteria related to the magnitude of their growth slowdowns.[4] Nor do they examine the income levels at which slowdowns occur or their determinants.

There are also some more distant cousins. Pritchett (2000) examines cases of developing countries where, following a period of sustained growth, growth stagnates or collapses. His is a more restrictive definition of growth slowdowns than the one with which we are concerned in this paper. Pritchett is also more concerned with mounting a critique of the typical cross-country growth regression than with identifying the determinants of shifts from sustained growth to stagnation or collapse, as here. Reddy and Miniou (2006) similarly study episodes of real income stagnation, which they find to be most prevalent in poor, conflict-ridden, and commodity-exporting countries. Again, we are not concerned with episodes of stagnation, however, but only with growth slowdowns. Finally, there are detailed studies of the determinants of growth collapses, such as Rodrik (1999), Ros (2005), and Hausmann, Rodriguez, and Wagner (2008). But growth collapses are even more radical than episodes of stagnation from the slowdowns that we seek to understand here.

The rest of our paper is organized as follows. Section 2 explains how we identify growth slowdowns. Section 3 describes the characteristics of the resulting sample. Sections 4 through 6 take various approaches to identifying the correlates and determinants of these slowdowns. Section 7 attempts to draw out the implications for China, and Section 8 concludes.

2. Identifying slowdowns

Our analysis of growth slowdowns builds on a symmetrical analysis of growth accelerations by Hausmann, Pritchett, and Rodrik (2005). We identify an episode as a growth slowdown if the rate of GDP growth satisfies three conditions:

4 Very small but statistically significant slowdowns qualify.

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$$g_{t,t-n} \leq 0.035, \tag{1}$$

$$g_{t,t-n} - g_{t,t+n} \leq 0.02, \tag{2}$$

$$y_t > 10{,}000, \tag{3}$$

where y_t is per capita GDP in 2005 constant international purchasing power parity (PPP) prices, and $g_{t,t+n}$ and $g_{t,t-n}$ are the average growth rate between year t and $t+n$ and the average growth rate between $t-n$ and t, respectively. Following Hausmann, Pritchett, and Rodrik (2005), we set $n = 7$. Data on per capital incomes are from Penn World Tables (PWT) Version 6.3, which covers the period 1957–2007.[5] Sources for the other variables are described in the Appendix.

The first condition requires that the 7-year average growth rate of per capita GDP is 3.5 percent or greater prior to the slowdown (earlier growth was fast). The second one identifies a growth slowdown with a decline in the 7-year average growth rate of per capital GDP by at least by 2 percentage points (the slowdown is non-negligible). The third condition limits slowdowns to cases in which per capita GDP is greater than US$ 10,000 in 2005 constant international PPP prices (ruling out growth crises in not yet successfully developing economies).

Table 1 lists all the slowdowns identified by this approach. In some cases the methodology identifies a string of consecutive years as growth slowdowns. For example, in Greece all years between 1969 and 1978 are identified as a slowdown. One way of dealing with this is to use a Chow test for structural breaks to select only one year out of the consecutive years identified. For Greece we would then select 1973 as the year of growth slowdown because the Chow test is most significant for that year. In Table 1, the years chosen by the Chow test are denoted in bold.

With this break point in hand, we next assign the value of 1 to the 3 years centered on the year of the growth slowdown, that is, the dummy equals 1 for $t = t - 1$, t and $t + 1$ and zero otherwise.[6] The comparison group consists of the countries that did not experience a growth slowdown in that same year. The sample includes all countries for which the relevant data are available including countries that have never experienced a growth slowdown. We drop all data pertaining to years $t + 2, \ldots$ $t + 7$ of the growth slowdown as a way of removing the transition period to which either a 0 or 1 may not be clearly assigned.

5 In what follows, we report some analysis using data for earlier periods as well.

6 Again, this directly follows Hausmann, Pritchett, and Rodrik (2005).

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Table 1. Growth slowdown episodes

Country	Year	Growth before slowdown ($t-7$ through t) (%)	Growth after slowdown (t through $t+7$) (%)	Difference in growth (%)	Per capita GDP at t
Argentina	**1970**	3.6	1.5	−2.2	10,927
	1997	4.3	−0.1	−4.5	12,778
	1998	3.7	0.5	−3.2	13,132
Australia	1968	4.2	1.7	−2.5	15,820
	1969	3.9	1.6	−2.3	16,326
Austria	**1961**	6.4	3.5	−3.0	10,293
	1974	4.9	2.2	−2.7	17,779
	1976	4.2	2.1	−2.1	18,615
	1977	4.0	1.5	−2.5	19,643
Bahrain	**1977**	4.2	−4.5	−8.7	28,824
Belgium	1973	4.6	2.5	−2.1	17,041
	1974	4.8	1.6	−3.2	17,782
	1976	3.8	1.1	−2.7	18,312
Chile	1994	5.9	3.9	−2.0	11,145
	1995	6.5	2.8	−3.7	12,223
	1996	6.1	2.3	−3.8	13,004
	1997	6.6	2.3	−4.3	13,736
	1998	6.1	2.7	−3.4	14,011
Denmark	1964	5.0	2.9	−2.1	13,450
	1965	5.4	2.8	−2.6	13,944
	1970	3.9	1.9	−2.0	16,223
Finland	1970	4.6	2.2	−2.4	13,266
	1971	4.1	2.0	−2.1	13,481
	1973	4.6	2.5	−2.1	14,996
	1974	5.3	1.8	−3.5	15,844
	1975	5.0	2.3	−2.7	15,777
France	1973	4.5	2.2	−2.3	16,904
	1974	4.4	1.6	−2.8	17,473
Gabon	**1976**	6.0	−2.6	−8.6	11,270
	1977	4.2	−1.7	−5.8	10,631
	1978	5.0	−4.0	−8.9	11,856
	1995	3.5	−2.9	−6.4	10,161
Greece	1969	7.4	4.9	−2.5	11,227
	1970	7.1	3.9	−3.2	12,102
	1971	6.9	3.6	−3.3	13,024
	1972	7.0	2.4	−4.5	14,323
	1973	7.5	1.3	−6.2	15,480
	1974	5.7	2.0	−3.7	14,248
	1975	5.5	1.1	−4.4	14,948
	1976	4.9	0.0	−4.9	15,779
	1977	3.9	0.1	−3.8	15,874
	1978	3.6	−0.3	−3.9	16,775
Hong Kong	**1978**	6.5	4.5	−2.0	13,643
	1988	5.6	3.2	−2.4	24,523
	1989	5.5	3.2	−2.4	24,867
	1990	5.7	3.0	−2.6	25,918
	1991	5.5	1.3	−4.2	27,273
	1992	6.1	0.9	−5.1	28,581
	1993	5.4	1.3	−4.1	29,726
	1994	4.4	0.7	−3.6	30,822
Hungary	1978	4.7	0.8	−3.9	10,295
	1979	3.9	1.3	−2.6	10,244
Iran	1972	9.4	−4.7	−14.0	10,690
	1973	9.5	−11.3	−20.8	11,236
	1974	8.2	−11.6	−19.8	11,015
	1975	5.5	−7.3	−12.8	10,040
	1976	6.2	−8.4	−14.6	11,385
Iraq	1979	10.9	−6.6	−17.5	11,823
	1980	7.9	−3.5	−11.5	11,129

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Table 1. ***(Continued)***

Country	Year	Growth before slowdown ($t-7$ through t) (%)	Growth after slowdown (t through $t+7$) (%)	Difference in growth (%)	Per capita GDP at t
Ireland	1969	4.4	2.3	−2.2	10,033
	1973	5.1	2.3	−2.8	11,667
	1974	4.6	2.5	−2.0	11,781
	1978	3.8	0.4	−3.4	13,469
	1979	3.5	−0.3	−3.8	14,091
	1999	7.4	4.7	−2.8	29,090
	2000	8.3	4.0	−4.3	31,389
Israel	1970	4.7	2.3	−2.5	11,869
	1971	5.0	1.6	−3.4	12,852
	1972	5.5	1.0	−4.5	13,861
	1973	6.9	−0.1	−7.0	14,502
	1974	7.6	0.1	−7.6	14,736
	1975	5.5	0.1	−5.5	14,986
	1996	3.7	−0.1	−3.8	20,973
Italy	**1974**	4.4	2.3	−2.1	15,629
Japan	1967	8.7	6.5	−2.2	10,041
	1968	8.7	5.0	−3.7	11,277
	1969	9.2	3.8	−5.3	12,565
	1970	9.5	2.9	−6.6	13,856
	1971	8.4	3.1	−5.3	14,263
	1972	8.8	2.8	−6.0	15,263
	1973	8.4	2.0	−6.4	16,326
	1974	6.5	2.8	−3.7	15,806
	1975	5.0	2.9	−2.1	15,965
	1990	4.2	1.2	−3.1	26,385
	1991	4.3	0.3	−4.0	27,184
	1992	3.7	0.2	−3.5	27,250
Korea, Republic of	1990	8.6	5.8	−2.8	11,908
	1991	8.7	2.6	−6.1	12,987
	1992	8.4	3.7	−4.7	13,391
	1993	7.9	4.0	−3.9	14,050
	1994	7.7	3.1	−4.5	15,316
	1995	7.3	2.9	−4.5	16,489
	1996	7.2	2.2	−5.0	17,613
	1997	5.8	2.5	−3.2	17,844
Kuwait	**1993**	6.7	−2.8	−9.5	44,043
	1994	6.3	−3.0	−9.3	43,031
	1995	6.7	−3.8	−10.5	43,746
	1996	4.2	−1.3	−5.5	42,232
	1997	8.5	0.1	−8.5	40,164
Lebanon	1983	9.3	−6.8	−16.1	10,081
	1984	6.3	−10.1	−16.4	15,107
	1985	6.2	−13.8	−20.0	16,192
	1987	6.3	−14.3	−20.7	18,411
Libya	1977	5.8	−11.3	−17.1	56,246
	1978	6.4	−10.0	−16.4	53,273
	1979	7.1	−12.0	−19.1	55,200
	1980	5.2	−12.4	−17.5	46,139
Malaysia	1994	6.7	3.4	−3.3	10,987
	1995	6.8	2.9	−4.0	11,835
	1996	6.9	2.4	−4.5	12,741
	1997	6.5	2.5	−4.0	13,297
Mauritius	**1992**	5.3	3.3	−2.0	11,183
Netherlands	**1970**	4.5	2.1	−2.4	17,387
	1973	3.7	1.7	−2.0	18,642
	1974	3.5	0.9	−2.7	19,184
New Zealand	**1960**	3.9	1.7	−2.2	12,406
	1965	4.2	1.0	−3.2	14,456
	1966	4.6	1.3	−3.2	15,070

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Table 1. ***(Continued)***

Country	Year	Growth before slowdown ($t-7$ through t) (%)	Growth after slowdown (t through $t+7$) (%)	Difference in growth (%)	Per capita GDP at t
Norway	**1976**	4.3	2.0	−2.3	21,849
	1997	4.0	1.6	−2.4	39,503
	1998	4.1	1.7	−2.4	40,614
Oman	1977	5.2	2.6	−2.6	14,183
	1978	8.7	2.0	−6.7	16,083
	1979	8.5	2.3	−6.2	16,081
	1980	8.2	4.6	−3.6	13,135
	1981	6.6	3.9	−2.7	14,638
Portugal	1973	8.2	1.4	−6.7	10,004
	1974	7.3	1.6	−5.7	10,025
	1990	4.4	2.1	−2.3	15,045
	1991	5.4	2.5	−2.9	15,406
	1992	5.4	2.8	−2.6	15,635
	2000	3.6	0.4	−3.2	19,606
Puerto Rico	1969	5.7	2.1	−3.6	10,094
	1970	5.8	2.0	−3.8	10,687
	1971	5.5	2.1	−3.4	11,205
	1972	5.3	1.4	−3.9	11,715
	1973	4.3	1.4	−2.9	11,556
	1988	4.7	2.2	−2.5	16,901
	1989	5.8	1.9	−4.0	17,795
	1990	5.0	2.4	−2.6	18,245
	1991	5.1	2.9	−2.3	18,588
	2000	4.1	0.1	−4.0	25,955
Saudi Arabia	**1977**	9.4	−8.8	−18.2	43,032
	1978	5.5	−8.3	−13.8	37,541
	1979	3.7	−9.7	−13.4	40,696
Singapore	1978	6.9	4.8	−2.1	11,429
	1979	6.4	3.6	−2.8	12,369
	1980	5.8	3.3	−2.5	13,399
	1982	6.4	4.2	−2.2	14,834
	1983	6.8	3.9	−2.9	16,271
	1984	6.7	4.0	−2.7	17,002
	1993	6.7	4.7	−2.0	25,451
	1994	7.0	2.5	−4.5	27,555
	1995	6.7	1.9	−4.9	29,369
	1996	6.3	0.9	−5.4	30,935
	1997	6.2	1.5	−4.7	32,986
Spain	1969	6.1	3.8	−2.3	11,262
	1972	5.2	1.7	−3.5	12,859
	1973	5.3	0.9	−4.3	13,830
	1974	5.6	−0.1	−5.7	14,551
	1975	4.7	0.2	−4.6	14,393
	1976	3.8	0.0	−3.8	14,673
	1990	3.8	1.6	−2.1	19,112
Taiwan	1994	6.2	3.8	−2.4	16,053
	1995	6.0	3.6	−2.4	16,936
	1996	5.8	3.3	−2.5	17,845
	1997	5.9	3.3	−2.7	18,832
	1998	5.6	3.3	−2.3	19,526
	1999	5.4	3.2	−2.2	20,562
Trinidad & Tobago	1978	4.6	−3.4	−8.1	12,959
	1980	3.6	−5.6	−9.3	13,671
United Arab Emirates	**1977**	22.6	−4.9	−27.6	76,701
	1978	20.8	−4.1	−24.9	65,394
	1979	21.4	−8.1	−29.6	69,445
	1980	16.1	−9.5	−25.5	74,229
United Kingdom	**1988**	3.7	1.2	−2.4	21,261
	1989	3.7	1.3	−2.4	21,733
United States	**1968**	3.9	1.4	−2.5	19,496

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Table 1. ***(Continued)***

Country	Year	Growth before slowdown ($t-7$ through t) (%)	Growth after slowdown (t through $t+7$) (%)	Difference in growth (%)	Per capita GDP at t
Uruguay	1996	3.6	−2.0	−5.6	11,044
	1997	4.3	−1.2	−5.5	11,559
	1998	4.4	−1.2	−5.6	12,097
Venezuela	**1974**	3.9	−2.2	−6.1	13,869
Average		5.6	2.1	−3.5	16,740

Source: *Authors' calculation.*

Note: *The per capita GDP data are collected from Penn World Table 6.3. Shaded countries are oil exporters. When we identify a string of consecutive years as growth slowdowns, we employ a Chow test for structural breaks to select only one year that is most significant. The selected years by the Chow test are denoted in* ***bold.***

In addition to focusing on the dates identified here, we also report the results when we do not employ the Chow test and leave the consecutive years as they are, namely, the dummy indicating a slowdown is set equal to one for the entire run of consecutive years (and, in addition to the observations for that country 1 year before and after those selected years of the growth slowdown). In our regression analysis we report the results both for the sample of all countries covered by PWT when the manufacturing employment share is not used as an explanatory variable, as well as for a somewhat smaller sample when we employ the manufacturing share. Finally, because oil-exporting countries exhibit volatile behavior and show growth slowdowns at per capita incomes differently than other countries (see subsequent discussion), we also report the results when oil countries are removed. (In Table 1, oil exporters are shaded.) Throughout, we report robust standard errors that consider the panel structure of the probit model.

3. What slowdowns look like

At the bottom of Table 1 we report the average values for all non-oil-exporting countries. On average, high growth came to an end at a per capita GDP of US$ 16,740, in 2005 constant international PPP prices. (The median is US$ 15,058.) At that point the growth rate slowed from 5.6 to 2.1 percent per annum. For purposes of comparison, note that China's per capita GDP, in constant 2005 international PPP prices, was US$ 8,511 as of 2007, India's was US$ 3,826, and Brazil's was US$ 9,645. These are the latest compatible figures provided by Penn World Tables.

Around the average of US$ 16,740 per capita GDP there is considerable variation. Figure 1 summarizes the frequency distribution by per capita income in the form of a bar graph, oil exporters excluded.[7] In some cases, explanations for these variations

7 On the exclusion of oil exporters see the subsequent discussion. The reader's eyes will no

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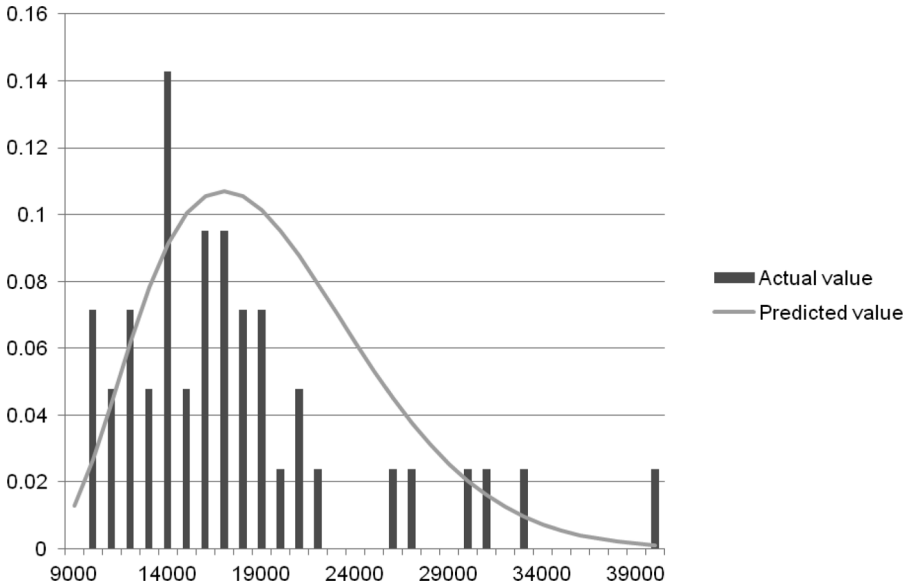
Figure 1. Frequency distribution of growth slowdowns (oil exporters excluded)



Source: *Authors' calculation.*

Note: *The bars indicate the frequency distribution of actual growth slowdowns by per capita income, and the smooth line is the predicted values of growth slowdowns derived from a probit model.*

are well known, although in others explaining them "will require further study." At this point we limit ourselves to a few observations.

First, the list in Table 1 passes the smell test that most of the episodes are well known and plausible. The methodology locates slowdowns for a number of European countries in the first half of the 1970s, when the quarter-century-long "golden age" of rapid economic growth inaugurated by the Marshall Plan and postwar recovery is widely seen as coming to a close (Crafts and Toniolo 1996). It detects a slowdown in Argentina in 1998, just prior to that country's financial difficulties coming to a head (as discussed by De la Torre, Levy-Yeyati, and Schmukler 2002). The slowdown in Korea is centered in 1997, again on the eve of a financial crisis, although in this case we see a steady but significant deceleration over the course of preceding years (as described in Eichengreen, Perkins, and Shin [forthcoming]).

doubt be drawn to the four high-income slowdowns in the figure. These are for Hong Kong, Singapore, Japan, and Norway, all of which are discussed further in what follows.

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A number of countries do not appear in this list, for good reason. Most of these, like China, continue to have per capita incomes below US$ 10,000 in 2005 international PPP prices and are therefore excluded by construction—the idea being that the kind of slower growth with which we are concerned should not simply be a conjectural phenomenon or a reflection of an inability to develop but rather should be associated with increasing economic maturity.[8] In practice, this condition does not appear to be especially restrictive. If we reduce the US$ 10,000 threshold to US$ 7,500, we do in fact pick up 15 additional cases, but most of these appear to be reflections of special circumstances that depressed growth relative to trend for an extended period rather than sustained slowdowns in increasingly mature economies. They include Portugal's slowdown around the time of its mid–1970s revolution, Romania when President Ceausescu put the economy through the wringer to repay the debt, Mexico's slowdown at the end of the 1970s and beginning of the 1980s when its foreign-borrowing binge came to an end, and the slowdown in Cuban growth over the course of the 1980s as Soviet aid was curtailed. For what it is worth, the mean income at which slowdowns occur falls from US$ 16,740 to US$ 15,092 when we reduce the minimum-income threshold from US$ 10,000 to US$ 7,500.[9]

Second, in the majority of the countries experiencing slowdowns, this event is centered at a single point in time and a particular level of per capita income. In a few exceptional cases, growth decelerates in steps. Japan is a well-known example: there is a first slowdown in the early 1970s (our methodology centers this on year 1970 itself, where the difference in the growth rate averages 6.6 percent per annum between the seven preceding and subsequent years), and then a second slowdown in the 1990s (centered on 1992, where the deceleration is an additional 3.5 percent). Obviously, these magnitudes are exceptional; there is no other country where slowdown episodes produce a cumulative deceleration of 10 percentage points (there being no other economy that both experienced such a dramatic economic miracle and then such a complete growth disaster). Qualitatively if not quantitatively, we see a similar pattern in Austria, which experienced a *Wirtschaftswunder* after World War II before decelerating first in 1961 and then again in 1974, and in Spain, where there is evidence of a two-step deceleration centered around 1974 and 1990.

Most other countries for which the methodology picks out more than one growth deceleration are cases where, after an extended period of slower growth, economic reforms lead to a period of faster growth followed by a second deceleration: examples include Argentina, Hong Kong, Ireland, Israel, Norway, Portugal, and Singa-

8 Or at least adolescence.

9 The median falls from US$ 15,058 to US$ 13,859.

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pore. In Norway the story is oil and natural gas, which led first to a marked uptick in growth in the 1980s and 1990s, giving way subsequently to deceleration. Still, in the vast majority of cases it seems appropriate to speak of a specific point in time and a particular level of per capita income at which a country's previously rapid rate of growth slowed down.

A final observation concerns outliers. Small open economies like Hong Kong and Singapore appear to experience their growth decelerations at unusually high levels of per capita GDP. It is tempting to also place Israel in this camp. It will be interesting to explore whether they are different because they are so small or because they are so open.

Oil exporters also are unusual in that they are able to maintain high rates until higher per capita incomes are reached than is customary for other countries. A moment's reflection suggests that this is obvious: large amounts of oil that can be extracted at low cost shift up the entire per capita income profile, other things equal. Note that this is not inconsistent with the well-known observation about the potential negative impact on growth of resource abundance ("the resource curse"), because we focus here on the change in growth rates around the time of the slowdown, and not on their earlier absolute rate. All that we require for inclusion in the sample is that per capita income was growing by at least 3.5 percent per annum over a period prior to the slowdown. But it clearly will be important to distinguish oil exporters and treat them differently from other countries in the analysis that follows.

4. Proximate sources of slowdowns

A first cut at the question of why slowdowns occur asks: which component of the standard growth-accounting framework—capital input, labor input, human capital input, or technical change—accounts for the bulk of the slowdown? To answer this question we use the standard growth-accounting framework, as implemented inter alia by Bernanke and Gurkaynak (2001), whose estimates of labor's share of income we utilize here. We measure labor input as population between the ages of 15 and 64, from the World Bank's *World Development Indicators,* and human capital data are from Barro and Lee (2010).

In Table 2 we report two sets of growth accounting results, the first of which uses labor share calculated à la Bernanke and Gurkaynak (2001), whereas the second simply sets labor's share equal to 0.65 for each country. In Table 2.1 we see that the contribution of the growth of the capital stock fell from 2.40 percent to 1.79 percent

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around the time of slowdowns. The contribution of labor growth fell more modestly, from 0.89 to just 0.86 percent, whereas that of the growth of human capital actually increased (from 0.44 to 0.51 percent). Much more dramatic is the decline in the contribution of total factor productivity (TFP) growth, from 3.04 to 0.09 percent. Growth slowdowns, in a nutshell, are productivity growth slowdowns.[10] About 85 percent of the slowdown in the rate of growth of output is explained by the slowdown in the rate of TFP growth. The details in Table 2.2 are different but the story is the same.[11]

The intuition for this is straightforward. Slowdowns coincide with the point in the growth process where it is no longer possible to boost productivity by shifting additional workers from agriculture to industry and where the gains from importing foreign technology diminish. But the sharpness and extent of the fall in TFP growth from unusually high levels of 3-plus percent to near zero is striking.

Next we consider the determinants of growth slowdowns using a probit model. Because the share of employment in manufacturing is likely to be important for the timing of growth slowdowns, initially we limit the sample to observations for which we have this information. We regress our binary indicator of slowdowns identified using the Chow-test methodology on per capita GDP, the ratio of per capita GDP to that in the lead country, the dependency ratio, and the manufacturing share of employment, all of which we enter as quadratics. In addition we include the crude fertility rate.

In Tables 3.1 and 3.2 we report summary statistics for these variables for the full sample countries, for countries experiencing growth slowdowns, and for China, a country of special interest in this context. Tables 4.1 and 4.2 summarize the basic regressions.

Per capita GDP is consistently the most important variable: both per capita GDP and its square are highly significant.[12] If we use the regression result in column (1), the peak probability of slowdown occurs when the per capita GDP reaches US$ 15,389 in 2005 international PPP prices, broadly in line with the simple statistics of Table 1. The ratio measure of per capita income also enters as expected, in column (2). The

10 The smaller contribution of capital accumulation may not be negligible, but it is dwarfed by the decline in the contribution of TFP growth.

11 The analogous figures are 2.49 to 1.88 percent for capital, 0.91 to 0.86 percent for labor, 0.45 to 0.50 percent for human capital, and 2.83 to 0.05 percent for TFP.

12 Here, and for that matter in virtually any specification.

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Table 2. Growth accounting results

Table 2.1. Growth accounting (%) when actual labor shares are used

		Capital		Labor		Human capital		Labor	
Country	Year	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown
Australia	1968	1.66	1.41	1.45	1.46	0.34	0.60	2.62	0.05
	1969	1.71	1.29	1.51	1.35	0.39	0.62	2.23	−0.02
Austria	**1961**	1.92	1.95		−0.06	0.23	1.12		1.10
	1974	1.97	1.35	0.15	0.47	0.68	0.38	2.55	−0.01
	1976	1.85	1.14	0.24	0.64	0.55	0.35	1.84	0.00
	1977	1.79	0.99	0.30	0.67	0.47	0.35	1.63	−0.55
Belgium	1973	1.20	0.98	0.24	0.45	0.38	0.55	3.17	0.71
	1974	1.21	0.85	0.27	0.46	0.44	0.53	3.21	−0.12
	1976	1.13	0.65	0.37	0.47	0.54	0.51	2.06	−0.47
Chile	1994	1.93	2.89	0.98	0.98	0.47	0.31	4.22	1.05
	1995	2.35	2.61	0.94	1.00	0.42	0.32	4.39	0.08
	1996	2.63	2.38	0.92	1.01	0.37	0.33	3.78	−0.25
	1997	2.90	2.18	0.91	1.02	0.33	0.34	4.01	−0.08
	1998	3.13	2.12	0.91	1.01	0.32	0.36	3.18	0.37
Denmark	1964	1.50	1.69		0.43	0.22	0.32		1.17
	1965	1.70	1.62		0.38	0.23	0.34		1.13
	1970	1.76	1.24	0.48	0.28	0.30	0.38	2.10	0.46
Finland	1970	1.60	1.47	0.54	0.49	0.63	0.83	2.10	−0.20
	1971	1.63	1.29	0.44	0.47	0.67	0.81	1.59	−0.14
	1973	1.56	1.14	0.43	0.35	0.73	0.77	2.13	0.56
	1974	1.64	0.99	0.42	0.33	0.76	0.65	2.71	0.17
	1975	1.70	0.88	0.42	0.33	0.79	0.53	2.41	0.90
France	1973	1.74	1.09	0.63	0.56	0.54	0.51	2.45	0.49
	1974	1.72	0.95	0.63	0.61	0.55	0.50	2.37	0.02
Greece	1969	2.14	1.86	0.22	0.43	−0.43	0.22	6.01	2.98
	1970	2.15	1.68	0.12	0.62	−0.31	0.27	5.64	2.12
	1971	2.10	1.49	0.09	0.75	−0.14	0.28	5.38	2.04
	1972	2.07	1.25	0.11	0.83	0.04	0.28	5.32	1.10
	1973	2.14	0.99	0.12	0.91	0.08	0.28	5.67	0.21
	1974	2.09	0.86	0.10	0.99	0.13	0.36	3.83	1.02
	1975	2.00	0.73	0.25	0.99	0.17	0.43	3.55	0.05
	1976	1.86	0.58	0.43	0.95	0.22	0.50	2.98	−1.03
	1977	1.68	0.47	0.62	0.89	0.27	0.57	2.12	−0.96
	1978	1.49	0.37	0.75	0.84	0.28	0.64	2.04	−1.45

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Table 2.1. *(Continued)*

		Capital		Labor		Human capital		Labor	
Country	Year	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown
Hong Kong	**1978**	3.48	3.75	2.05	1.54	0.55	0.62	2.47	0.80
	1988	3.00	2.95	0.82	0.96	0.59	0.28	2.31	0.40
	1989	2.81	3.03	0.73	1.13	0.59	0.21	2.40	0.51
	1990	2.77	3.14	0.65	1.23	0.59	0.14	2.54	0.42
	1991	2.76	3.07	0.66	1.21	0.54	0.13	2.43	−1.26
	1992	2.84	2.84	0.68	1.18	0.48	0.12	3.01	−1.42
	1993	2.85	2.72	0.73	1.12	0.41	0.11	2.47	−1.01
	1994	2.90	2.46	0.82	1.01	0.34	0.14	1.50	−1.44
Ireland	1969	1.26	1.51	0.36	1.07	0.19	0.55	3.08	0.53
	1973	1.58	1.45	0.67	1.24	0.33	0.61	3.41	0.45
	1974	1.67	1.39	0.79	1.22	0.40	0.62	2.78	0.70
	1978	1.53	1.16	1.22	0.96	0.62	0.64	1.96	−1.41
	1979	1.56	0.95	1.27	0.79	0.61	0.61	1.62	−1.92
	1999	1.26	1.75	1.24	1.13	0.61	0.44	5.08	2.51
	2000	1.51	1.67	1.26	1.05	0.62	0.41	5.78	2.06
Israel	1970	1.91	2.26	2.05	1.62	0.42	0.68	3.03	0.36
	1971	1.95	2.00	1.96	1.47	0.47	0.69	3.17	−0.06
	1972	2.05	1.75	1.92	1.36	0.52	0.70	3.63	−0.47
	1973	2.25	1.46	1.94	1.28	0.55	0.70	4.89	−1.32
	1974	2.49	1.21	1.94	1.21	0.57	0.67	5.47	−0.93
	1975	2.57	1.03	1.88	1.20	0.60	0.64	3.32	−0.81
	1996	1.96	1.31	2.65	1.76	0.34	0.33	2.11	−1.17
Italy	**1974**	1.63	1.00	0.24	0.45	0.35	0.46	2.90	0.72
Japan	1967	4.22	4.08	1.36	0.76	0.09	0.52	3.98	2.38
	1968	4.18	3.76	1.28	0.72	0.10	0.62	4.13	1.15
	1969	4.22	3.41	1.18	0.68	0.10	0.68	4.70	0.32
	1970	4.31	3.01	1.06	0.65	0.10	0.74	5.08	−0.28
	1971	4.26	2.72	0.95	0.62	0.21	0.69	4.09	0.26
	1972	4.28	2.47	0.86	0.59	0.32	0.64	4.49	0.20
	1973	4.27	2.18	0.81	0.57	0.42	0.59	4.12	−0.28
	1974	4.08	2.00	0.76	0.55	0.52	0.56	2.38	0.63
	1975	3.76	1.88	0.72	0.54	0.62	0.52	1.15	0.81
	1990	1.51	1.21	0.63	0.10	0.45	0.38	2.15	−0.24
	1991	1.60	1.06	0.59	0.04	0.42	0.38	2.17	−0.87
	1992	1.62	0.92	0.53	−0.02	0.40	0.38	1.54	−0.86
Korea, Republic of	1990	3.72	3.72	1.38	0.90	0.73	0.70	3.81	1.41
	1991	3.88	3.22	1.34	0.82	0.73	0.65	3.74	−1.19
	1992	3.98	2.93	1.31	0.74	0.73	0.60	3.41	0.24

		1993	4.02	2.71	1.25	0.67	0.74	0.56	2.93	0.87
		1994	4.04	2.42	1.16	0.61	0.75	0.51	2.76	0.38
		1995	4.01	2.14	1.07	0.54	0.76	0.46	2.50	0.45
		1996	3.95	1.86	0.98	0.47	0.73	0.46	2.48	0.09
		1997	3.72	1.69	0.90	0.41	0.70	0.45	1.41	0.62
	Malaysia	1994	3.07	2.47	1.79	1.89	0.84	0.52	3.30	0.67
		1995	3.46	2.02	1.78	1.86	0.84	0.49	3.03	0.56
		1996	3.72	1.60	1.79	1.80	0.78	0.51	2.83	0.48
		1997	3.89	1.21	1.82	1.74	0.72	0.53	2.34	1.02
	Mauritius	**1992**	2.39	2.21	0.86	0.79	0.54	0.14	2.42	1.29
	Netherlands	**1970**	2.01	1.26	0.95	0.91	0.94	0.60	1.83	0.25
		1973	1.81	0.99	0.86	0.93	0.82	0.56	1.32	−0.03
		1974	1.72	0.86	0.87	0.95	0.76	0.54	1.22	−0.76
	New Zealand	**1960**	1.09	1.37		1.49	0.21	0.32		0.50
		1965	1.22	1.06		1.16	0.19	0.70		−0.49
		1966	1.37	1.05		1.23	0.26	0.72		−0.14
	Norway	**1976**	1.96	1.17	0.36	0.39	0.29	0.55	2.35	0.23
		1997	0.52	0.98	0.31	0.47	0.36	0.69	3.35	0.02
		1998	0.72	0.96	0.34	0.46	0.36	0.76	3.24	0.01
	Portugal	1973	2.19	1.36	−0.25	1.03	0.46	0.68	5.57	−0.41
		1974	2.20	1.31	−0.05	0.98	0.51	0.69	4.65	−0.20
		1990	0.92	1.25	0.44	0.46	0.65	0.29	2.44	0.45
		1991	1.09	1.29	0.41	0.50	0.59	0.30	3.38	0.83
		1992	1.25	1.34	0.39	0.51	0.52	0.32	3.25	1.13
		2000	1.43	0.88	0.48	0.22	0.33	0.45	1.84	−0.75
	Singapore	1978	4.15	4.37	1.73	1.62	0.01	0.62	2.59	0.42
		1979	4.05	4.10	1.67	1.48	−0.02	0.69	2.18	−0.65
		1980	4.05	3.80	1.58	1.48	−0.05	0.76	1.59	−0.65
		1982	4.05	3.14	1.92	1.20	0.20	0.60	2.49	0.80
		1983	4.19	2.90	1.82	1.30	0.34	0.53	2.74	1.00
		1984	4.42	2.63	1.77	1.34	0.48	0.51	2.39	1.46
		1993	2.78	3.40	1.57	1.34	0.56	0.68	4.54	2.06
		1994	2.89	3.21	1.56	1.32	0.61	0.64	4.86	−0.02
		1995	3.11	2.89	1.51	1.25	0.67	0.60	4.44	−0.47
		1996	3.32	2.33	1.48	1.16	0.71	0.57	3.90	−0.98
		1997	3.53	1.88	1.48	1.08	0.75	0.55	3.56	−0.10
	Spain	1969	3.17	2.43	0.44	0.61	0.23	0.80	3.34	0.94
		1972	2.84	1.91	0.38	0.81	0.42	0.78	2.59	−0.69
		1973	2.74	1.68	0.41	0.83	0.52	0.74	2.60	−1.29
		1974	2.70	1.38	0.45	0.85	0.63	0.68	2.80	−1.97
		1975	2.61	1.17	0.52	0.85	0.74	0.62	1.83	−1.52
		1976	2.43	0.98	0.61	0.83	0.80	0.59	0.94	−1.55
		1990	1.11	1.06	0.68	0.37	0.45	1.39	1.96	−0.99

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Table 2.1. *(Continued)*

Country	Year	Capital		Labor		Human capital		Labor	
		Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown
Trinidad & Tobago	1978	2.59	2.20	1.85	1.38	0.55	0.32	0.97	−5.63
	1980	3.10	1.23	1.83	1.16	0.54	0.24	−0.41	−6.62
United Kingdom	**1988**	0.62	0.65	0.33	0.09	0.21	0.27	2.70	0.54
	1989	0.72	0.59	0.29	0.12	0.22	0.29	2.73	0.62
United States	**1968**	0.99	0.97	1.14	1.34	0.77	0.72	2.31	−0.55
Uruguay	1996	0.92	0.70	0.43	0.36	0.23	0.18	2.71	−2.61
	1997	1.18	0.51	0.42	0.36	0.25	0.12	3.15	−1.58
	1998	1.42	0.30	0.41	0.37	0.27	0.05	3.02	−1.30
Venezuela	**1974**	2.60	2.45	2.09	2.07	0.59	0.71	1.99	−4.39
Average (non-oil countries)		2.40	1.79	0.89	0.86	0.44	0.51	3.04	0.09

Source: *Authors' calculation.*

Note: *This table reports the 7-year average contribution of each input to the growth rate of the aggregate GDP before and after the growth slowdown. The actual labor share is obtained from Bernanke and Gurkaynak (2001). The GDP data are from Penn World Table 3.1. The labor force data are from World Development Indicators. The human capital data are from Barro and Lee (2010). We construct capital data by using the standard approach of assuming that the economy is initially in a steady state. Then the remaining capital stock is constructed by the perpetual inventory method.*

Table 2.2. Growth accounting (%) when the labor share is set equal to 0.65

Country	Year	Capital		Labor		Human capital		TFP	
		Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown
Argentina	**1970**	1.72	1.67	0.96	0.95	0.27	0.42	2.14	0.11
	1997	0.90	0.46	1.03	0.86	0.31	0.20	3.34	−0.66
	1998	1.13	0.38	1.00	0.88	0.28	0.21	2.55	0.05
Australia	1968	1.81	1.54	1.38	1.39	0.33	0.57	2.54	0.01
	1969	1.87	1.41	1.44	1.29	0.37	0.59	2.15	−0.05
Austria	**1961**	2.24	2.27		−0.06	0.22	1.04		0.85
	1974	2.29	1.57	0.14	0.43	0.63	0.36	2.28	−0.18
	1976	2.15	1.32	0.22	0.59	0.51	0.33	1.58	−0.12
	1977	2.09	1.16	0.28	0.62	0.44	0.32	1.39	−0.64
Bahrain	**1977**	2.62	3.02	3.95	4.09	1.11	1.27	0.90	−8.32

Belgium	1973	1.61	1.31	0.21	0.39	0.33	0.48	2.83	0.49
	1974	1.63	1.15	0.24	0.40	0.38	0.47	2.88	−0.29
	1976	1.53	0.88	0.33	0.41	0.47	0.45	1.78	−0.58
Chile	1994	1.65	2.47	1.08	1.08	0.51	0.34	4.36	1.34
	1995	2.01	2.23	1.04	1.10	0.46	0.35	4.59	0.33
	1996	2.24	2.03	1.01	1.12	0.41	0.37	4.03	−0.03
	1997	2.47	1.86	1.00	1.12	0.36	0.38	4.31	0.10
	1998	2.68	1.81	1.00	1.11	0.35	0.39	3.51	0.54
Denmark	1964	1.81	2.04		0.39	0.20	0.29		0.88
	1965	2.05	1.96		0.34	0.21	0.31		0.85
	1970	2.13	1.49	0.44	0.25	0.28	0.35	1.80	0.26
Finland	1970	1.93	1.77	0.50	0.45	0.58	0.76	1.87	−0.39
	1971	1.97	1.56	0.40	0.43	0.61	0.74	1.34	−0.30
	1973	1.88	1.38	0.39	0.32	0.67	0.71	1.91	0.42
	1974	1.97	1.20	0.39	0.30	0.70	0.60	2.48	0.04
	1975	2.05	1.07	0.38	0.30	0.72	0.48	2.16	0.79
France	1973	2.34	1.47	0.55	0.49	0.48	0.45	1.99	0.24
	1974	2.31	1.29	0.55	0.53	0.48	0.44	1.92	−0.18
Gabon	**1976**	5.02	1.85	2.48	0.69	0.50	0.96	2.42	−4.31
	1977	5.58	1.28	2.51	0.75	0.59	0.94	0.03	−2.75
	1978	5.40	1.51	2.55	0.81	0.68	0.92	0.96	−5.25
	1995	0.19	0.61	1.51	2.23	0.86	0.71	3.41	−3.67
Greece	1969	3.56	3.10	0.18	0.35	−0.36	0.18	4.55	1.85
	1970	3.59	2.79	0.10	0.51	−0.25	0.22	4.17	1.16
	1971	3.50	2.49	0.07	0.62	−0.11	0.23	3.97	1.22
	1972	3.45	2.08	0.09	0.69	0.03	0.23	3.97	0.46
	1973	3.57	1.65	0.10	0.75	0.07	0.23	4.27	−0.24
	1974	3.48	1.43	0.08	0.82	0.10	0.29	2.47	0.69
	1975	3.33	1.22	0.21	0.81	0.14	0.36	2.29	−0.19
	1976	3.10	0.97	0.35	0.78	0.18	0.41	1.85	−1.16
	1977	2.79	0.78	0.51	0.73	0.22	0.47	1.16	−1.02
	1978	2.49	0.62	0.62	0.69	0.23	0.53	1.22	−1.43
Hong Kong	**1978**	2.84	3.05	2.34	1.76	0.63	0.71	2.76	1.20
	1988	2.44	2.40	0.94	1.10	0.67	0.32	2.67	0.77
	1989	2.29	2.47	0.84	1.29	0.68	0.24	2.74	0.89
	1990	2.25	2.56	0.74	1.41	0.68	0.15	2.88	0.82
	1991	2.24	2.50	0.75	1.38	0.61	0.14	2.78	−0.87
	1992	2.32	2.31	0.78	1.35	0.54	0.13	3.38	−1.07
	1993	2.32	2.21	0.83	1.28	0.47	0.12	2.84	−0.67
	1994	2.36	2.00	0.93	1.15	0.39	0.16	1.88	−1.14
Hungary	1978	1.82	0.84	−0.06	0.09	0.48	0.33	2.90	−0.46
	1979	1.82	0.70	−0.13	0.14	0.49	0.27	2.16	0.09

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Table 2.2. *(Continued)*

		Capital		Labor		Human capital		TFP	
Country	Year	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown
Iran	1972	3.64	4.12	1.89	2.01	0.36	0.57	6.35	−8.31
	1973	3.46	3.94	1.89	2.12	0.37	0.60	6.68	−14.70
	1974	3.51	3.37	1.88	2.25	0.38	0.66	5.24	−14.42
	1975	3.76	2.61	1.89	2.38	0.40	0.71	2.34	−9.34
	1976	4.08	1.98	1.90	2.49	0.45	0.73	2.59	−9.81
Iraq	1979	4.45	5.08	1.95	2.50	0.54	0.70	7.40	−11.44
	1980	4.47	4.70	2.05	2.33	0.57	0.74	4.26	−8.12
Ireland	1969	1.64	1.96	0.32	0.95	0.17	0.49	2.77	0.26
	1973	2.04	1.87	0.59	1.10	0.29	0.54	3.05	0.23
	1974	2.17	1.80	0.70	1.09	0.36	0.55	2.41	0.49
	1978	1.98	1.50	1.09	0.85	0.55	0.57	1.71	−1.57
	1979	2.02	1.23	1.13	0.71	0.55	0.54	1.36	−2.05
	1999	1.64	2.27	1.10	1.01	0.55	0.39	4.91	2.16
	2000	1.95	2.17	1.13	0.93	0.55	0.36	5.54	1.72
Israel	1970	2.23	2.64	1.91	1.50	0.39	0.63	2.88	0.14
	1971	2.28	2.33	1.82	1.37	0.44	0.64	3.02	−0.24
	1972	2.39	2.04	1.78	1.27	0.49	0.65	3.46	−0.62
	1973	2.62	1.70	1.80	1.19	0.51	0.65	4.69	−1.42
	1974	2.90	1.42	1.80	1.12	0.53	0.62	5.24	−1.00
	1975	2.99	1.20	1.75	1.12	0.56	0.59	3.07	−0.85
	1996	2.29	1.53	2.46	1.64	0.32	0.31	1.99	−1.24
Italy	**1974**	1.96	1.21	0.22	0.41	0.32	0.42	2.62	0.59
Japan	1967	4.62	4.47	1.30	0.72	0.09	0.50	3.65	2.06
	1968	4.57	4.12	1.23	0.69	0.09	0.60	3.79	0.86
	1969	4.62	3.73	1.13	0.65	0.10	0.65	4.36	0.06
	1970	4.72	3.29	1.01	0.62	0.10	0.71	4.73	−0.50
	1971	4.66	2.98	0.90	0.59	0.20	0.66	3.74	0.06
	1972	4.68	2.70	0.82	0.56	0.31	0.61	4.14	0.03
	1973	4.67	2.38	0.77	0.54	0.40	0.57	3.77	−0.43
	1974	4.47	2.18	0.72	0.53	0.50	0.53	2.06	0.49
	1975	4.12	2.05	0.69	0.52	0.60	0.50	0.86	0.68
	1990	1.66	1.33	0.60	0.10	0.43	0.36	2.05	−0.33
	1991	1.75	1.16	0.56	0.03	0.41	0.36	2.07	−0.95
	1992	1.77	1.01	0.51	−0.02	0.38	0.37	1.43	−0.93
Korea, Republic of	1990	3.72	3.72	1.38	0.90	0.73	0.70	3.81	1.41
	1991	3.88	3.22	1.34	0.82	0.73	0.65	3.74	−1.19

	1992	3.98	2.93	1.31	0.74	0.73	0.60	3.41	0.24
	1993	4.02	2.71	1.25	0.67	0.74	0.56	2.93	0.87
	1994	4.04	2.42	1.16	0.61	0.75	0.51	2.76	0.38
	1995	4.01	2.14	1.07	0.54	0.76	0.46	2.50	0.45
	1996	3.95	1.86	0.98	0.47	0.73	0.46	2.48	0.09
	1997	3.72	1.69	0.90	0.41	0.70	0.45	1.41	0.62
Kuwait	**1993**	0.37	0.08	−1.20	3.51	0.18	0.29	4.48	−2.62
	1994	0.28	0.14	−0.90	3.19	0.19	0.26	3.90	−2.68
	1995	0.25	0.30	−0.64	2.91	0.19	0.23	4.10	−3.50
	1996	0.33	0.44	−0.48	2.71	0.21	0.18	1.38	−0.97
	1997	0.29	0.74	−0.45	2.59	0.23	0.13	5.71	0.12
Libya	1977	3.54	2.66	2.68	2.50	0.57	0.84	3.45	−13.17
	1978	3.67	2.26	2.59	2.44	0.66	0.80	3.70	−11.60
	1979	3.64	1.81	2.57	2.18	0.74	0.79	4.31	−13.45
	1980	3.57	1.22	2.46	2.15	0.82	0.78	2.35	−13.45
Malaysia	1994	3.16	2.54	1.77	1.86	0.83	0.51	3.24	0.64
	1995	3.56	2.08	1.76	1.83	0.82	0.48	2.97	0.54
	1996	3.83	1.65	1.77	1.77	0.77	0.50	2.76	0.46
	1997	4.01	1.25	1.80	1.71	0.71	0.53	2.26	1.02
Mauritius	**1992**	1.95	1.80	0.98	0.90	0.62	0.16	2.67	1.57
Netherlands	**1970**	2.13	1.34	0.92	0.88	0.91	0.58	1.77	0.22
	1973	1.91	1.05	0.84	0.90	0.80	0.55	1.26	−0.04
	1974	1.82	0.91	0.84	0.92	0.74	0.53	1.17	−0.77
New Zealand	**1960**	1.15	1.45		1.45	0.21	0.31		0.48
	1965	1.30	1.12		1.13	0.18	0.68		−0.50
	1966	1.45	1.11		1.20	0.25	0.70		−0.14
Norway	**1976**	1.76	1.05	0.38	0.42	0.31	0.59	2.51	0.29
	1997	0.47	0.88	0.34	0.50	0.38	0.74	3.36	0.04
	1998	0.65	0.86	0.36	0.49	0.39	0.81	3.27	0.03
Portugal	1973	2.73	1.70	−0.23	0.93	0.42	0.61	5.05	−0.58
	1974	2.75	1.63	−0.04	0.88	0.46	0.62	4.14	−0.36
	1990	1.16	1.56	0.40	0.41	0.59	0.26	2.31	0.21
	1991	1.36	1.61	0.37	0.45	0.53	0.27	3.20	0.58
	1992	1.57	1.67	0.35	0.46	0.47	0.29	3.03	0.87
	2000	1.78	1.09	0.44	0.20	0.30	0.40	1.56	−0.91
Saudi Arabia	**1977**	4.57	3.36	2.69	4.48	0.26	0.62	5.96	−10.97
	1978	4.85	2.48	3.05	4.42	0.33	0.62	1.94	−9.74
	1979	4.83	1.99	3.43	4.25	0.41	0.63	0.23	−10.84
Singapore	1978	3.09	3.25	2.12	1.99	0.01	0.76	3.26	1.03
	1979	3.02	3.06	2.04	1.81	−0.02	0.85	2.84	−0.09
	1980	3.02	2.83	1.94	1.82	−0.06	0.93	2.28	−0.18
	1982	3.01	2.34	2.35	1.47	0.24	0.74	3.04	1.20
	1983	3.12	2.16	2.24	1.59	0.42	0.64	3.32	1.32

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Table 2.2. ***(Continued)***

Country	Year	Capital		Labor		Human capital		TFP	
		Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown	Before slowdown	After slowdown
	1984	3.29	1.96	2.18	1.64	0.59	0.63	3.01	1.71
	1993	2.07	2.53	1.92	1.65	0.68	0.83	4.77	2.47
	1994	2.15	2.39	1.91	1.62	0.75	0.78	5.10	0.35
	1995	2.31	2.15	1.85	1.54	0.82	0.74	4.74	−0.15
	1996	2.47	1.74	1.81	1.43	0.87	0.70	4.25	−0.78
	1997	2.63	1.40	1.82	1.32	0.92	0.67	3.96	0.02
Spain	1969	3.36	2.58	0.43	0.59	0.22	0.78	3.17	0.83
	1972	3.02	2.03	0.37	0.79	0.40	0.76	2.44	−0.76
	1973	2.90	1.78	0.39	0.81	0.51	0.72	2.46	−1.34
	1974	2.87	1.47	0.44	0.82	0.61	0.66	2.67	−2.01
	1975	2.76	1.24	0.50	0.82	0.71	0.60	1.71	−1.55
	1976	2.58	1.04	0.59	0.80	0.78	0.58	0.83	−1.57
	1990	1.18	1.13	0.66	0.35	0.44	1.35	1.93	−1.01
Taiwan	1994	3.33	2.68	0.96	0.74	0.66	0.65	2.27	0.58
	1995	3.31	2.41	1.02	0.74	0.66	0.68	2.02	0.57
	1996	3.25	2.18	0.97	0.73	0.65	0.70	1.84	0.37
	1997	3.27	2.01	1.06	0.76	0.64	0.72	1.89	0.43
	1998	3.26	1.81	1.00	0.77	0.64	0.75	1.60	0.53
	1999	3.13	1.65	0.91	0.79	0.63	0.72	1.57	0.50
Trinidad & Tobago	1978	2.92	2.49	1.75	1.30	0.52	0.30	0.77	−5.81
	1980	3.50	1.39	1.73	1.09	0.51	0.23	−0.68	−6.69
United Arab Emirates	**1977**	13.34	5.32	10.51	5.70	0.48	0.37	12.72	−7.31
	1978	13.50	4.29	10.08	5.01	0.42	0.41	10.97	−5.83
	1979	13.42	3.44	9.53	4.37	0.36	0.49	11.94	−9.41
	1980	12.51	2.69	9.02	3.75	0.30	0.57	7.64	−10.42
United Kingdom	**1988**	0.86	0.91	0.29	0.08	0.18	0.24	2.52	0.33
	1989	1.01	0.83	0.25	0.10	0.19	0.25	2.51	0.44
United States	**1968**	1.33	1.31	1.00	1.18	0.68	0.63	2.20	−0.64
Uruguay	1996	0.76	0.58	0.48	0.40	0.26	0.20	2.79	−2.56
	1997	0.99	0.43	0.48	0.40	0.28	0.13	3.27	−1.55
	1998	1.19	0.25	0.46	0.42	0.31	0.06	3.18	−1.30
Venezuela	**1974**	1.94	1.82	2.56	2.54	0.72	0.87	2.05	−4.39
Average (non-oil countries)		2.53	1.82	0.90	0.84	0.45	0.50	2.83	0.05

Source: *Authors' calculation.*

Note: *See note for Table 2.1.*

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Table 3. Summary statistics

Table 3.1. Summary statistics, full sample

	Observations	Mean	Std. Dev.	Min	Max
Per capita GDP	4,486	6,965.000)	7,451	153	41,777
Ratio	4,486	.278	.274	.005	1.282
Dependency	4,219	77.3	18.4	37.1	112.8
Old dependency	4,219	9.7	5.7	2.3	27.8
Young dependency	4,219	67.6	23.0	21.3	106.5
Trade openness	4,486	.567	.430	.011	3.990
Financial openness	2,977	−.225	1.423	−1.831	2.500
Growth of terms of trade	3,213	−.006	.130	−1.031	1.222
Positive political change	4,108	.252	.434	0	1
Negative political change	4,108	.161	.368	0	1
Consumption share of GDP	4,486	.669	.151	.141	.998
Investment share of GDP	4,486	.196	.112	−.143	.674
Government share of GDP	4,486	.172	.098	.007	.753
Aggregate GDP growth rate	4,438	.038	.062	−1.108	.718
Capital contribution to GDP growth	2,216	.016	.015	−.015	.163
	(4,410)	(.016)	(.016)	(−.032)	(.525)
Employment contribution to GDP growth	2,047	.012	.008	−.026	.084
	(4,193)	(.014)	(.009)	(−.100)	(.123)
Human capital contribution to GDP growth	2,224	.004	.003	−.010	.020
	(4,092)	(.004)	(.003)	(−.009)	(.025)
TFP contribution to GDP growth	2,045	.008	.044	−.462	.280
	(3,775)	(.004)	(.058)	(−1.010)	(.677)

Source: *Authors' calculation.*

Note: *Values in parentheses are summary statistics for the sample used for growth accounting when we set labor share equal to .65 for every country.*

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Table 3.2. Summary statistics, slowdown countries and China

	Obs.	Mean	Std. Dev.	Min	Max	China 2007 PWT Version 1	China average[a] PWT Version 2	China 2007	China average*
Per capita GDP	142	16,740	5,980	10,004	40,614	8,511	5,402	7,868	5,505
Ratio	142	.640	.176	.322	1.109	.198	.134	.183	.136
Dependency	126	54.2	9.0	38.6	73.5	40.4	45.1	40.4	45.1
Old dependency	126	14.8	5.2	6.2	24.3	11.0	10.4	11.0	10.4
Young dependency	126	39.4	8.6	23.8	61.0	29.4	34.7	29.4	34.7
Trade openness	142	.843	.900	.093	3.990	.690	.530	.746	.520
Financial openness	109	.610	1.404	−1.831	2.500	−1.14	−1.14	−1.14	−1.14
Growth of terms of trade	125	−.010	.060	−.224	.176	−.025	−.033	−.025	−.033
Positive political change	124	.145	.354	0	1	0	0	0	0
Negative political change	124	.073	.260	0	1	0	0	0	0
Consumption share of GDP	142	.535	.092	.327	.851	.375	.440	.365	.443
Investment share of GDP	142	.346	.093	.159	.584	.324	.313	.313	.316
Government share of GDP	142	.125	.064	.039	.405	.202	.223	.214	.217
Aggregate GDP GROWTH RATE	142	.064	.033	−.079	.143	.140	.099	.104	.084
Capital contribution to GDP growth	121	.026	.009	.010	.053				
	(142)	(.025)	(.011)	(.009)	(.048)	(.040)	(.034)	(.040)	(.034)
Employment contribution to GDP growth	120	.009	.006	−.002	.033				
	(141)	(.009)	(.006)	(−.004)	(.027)	(.007)	(.009)	(.007)	(.009)
Human Capital contribution to GDP growth	121	.005	.003	−.001	.013				
	(132)	(.005)	(.003)	(−.001)	(.012)	(.005)	(.006)	(.005)	(.006)
TFP contribution to GDP growth	120	.025	.028	−.099	.086				
	(131)	(.023)	(.027)	(−.107)	(.080)	(.088)	(.051)	(.052)	(.036)

Source: *Authors' calculation.*

Note: *Values in parentheses are summary statistics for the sample used for growth accounting when we set labor share equal to .65 for every country. There are two versions of Penn World Table (PWT) statistics, Version 1 and Version 2 for China.*

a. China average refers to China's average value for the last 10 years.

Table 4. Determinants of growth slowdowns for countries with manufacturing employment share data

Table 4.1. Determinants of growth slowdowns for countries with manufacturing employment share data, probit regressions using Chow test points

	Growth slowdown					
	(1)	(2)	(3)	(4)	(5)	(6)
Per capita GDP	51.15*		79.92*	99.27**	114.15**	110.11**
	(26.09)		(35.81)	(33.01)	(39.41)	(40.91)
Per capital GDP^2	−2.65*		−2.45	−5.05**	−5.81**	−5.59**
	(1.35)		(1.29)	(1.68)	(2.01)	(2.09)
Pre-slowdown growth				48.18**	46.74**	48.83**
				(16.15)	(17.11)	(15.67)
Ratio		10.68*	−106.19			
		(4.64)	(58.51)			
Ratio^2		−9.23*	40.93			
		(4.38)	(23.89)			
Dependency					0.07	0.19
					(0.37)	(0.35)
Dependency^2					−0.00	−0.00
					(0.00)	(0.00)
Fertility					0.70	0.70
					(0.67)	(0.76)
Manufacturing employment share						115.79*
						(58.21)
Manufacturing employment share^2						256.79*
						(131.10)
Pseudo R-square	0.22	0.20	0.25	0.43	0.44	0.48
Observations	339.00*	339	339	332	332	332
Country	21					

Source: *Authors' calculation.*

Note: *The sample includes only those countries for which the manufacturing employment share data are available. The manufacturing employment share is collected from EUKLEMS. If a string of consecutive years are identified as growth slowdowns, we employ a Chow test for structural breaks to select only one for which the Chow test is most significant. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

Table 4.2. Determinants of growth slowdowns for countries with manufacturing employment share data, probit regressions using consecutive points

	Growth slowdown					
	(1)	(2)	(3)	(4)	(5)	(6)
Per capita GDP	44.47*		53.73	122.76**	177.26**	186.98**
	(21.40)		(54.62)	(28.51)	(29.17)	(26.92)
Per capital GDP^2	−2.35*		−0.79	−6.310**	−9.11**	−9.61**
	(1.13)		(2.30)	(1.47)	(1.48)	(1.38)
Pre-slowdown growth				94.04**	95.29**	99.24**
				(14.21)	(15.22)	(13.81)
Ratio		14.53*	−127.26*			
		(5.80)	(57.80)			
Ratio^2		−13.41*	47.72			
		(5.56)	(24.64)			
Dependency					−0.88	−0.70
					(0.45)	(0.46)

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Table 4.2. ***(Continued)***

	Growth slowdown					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dependency^2					0.01	0.01
					(0.00)	(0.00)
Fertility					1.53	1.77*
					(0.80)	(0.84)
Manufacturing employment share						157.79*
						(76.35)
Manufacturing employment share^2						−359.63*
						(171.25)
Pseudo R-square	0.31	0.31	0.37	0.64	0.69	0.73
Observations	389	389	389	382	382	382
Country	21					

Source: *Authors' calculation.*

Note: *The sample includes only those countries for which the manufacturing employment share data are available. The manufacturing employment share is collected from EUKLEMS. We use the entire string of consecutive years as growth slowdowns. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

results there suggest that a growth slowdown typically occurs when per capita income reaches 58 percent of that in the lead country. Analytically, it makes little sense to enter both per capita income and per capita income as a share of that in the lead country in the same equation, because their coefficients would imply that the slowdown began at different income levels. Still, it is interesting to know which term—per capita income in levels or per capita income relative to the lead country—dominates when we run a horserace between them. The result of that horserace, in column (3), suggests that the terms in the level of per capita income are somewhat "stronger" (more robustly determined). We therefore use per capita income in levels rather than as a ratio to that in the lead country in the basic regressions that follow.

In addition, the manufacturing employment share and the manufacturing employment share squared are also significant. The peak probability occurs when manufacturing accounts for 23 percent of total employment. Interestingly, the dependency-ratio variables are not statistically significant, and the fertility rate, when significant, enters with a positive coefficient.

It is plausible that the likelihood of a growth slowdown increases as well with the speed of growth in the 7-year pre-slowdown period. Intuitively, the more aggressive the exceptional measures taken to boost the economy's rate of growth, the less likely it is that its exceptionally rapid growth can be maintained. Consistent with this presumption, the pre-crisis growth rate enters positively and highly significantly in columns (4)–(6) in Table 4.1; the other effects for their part remain unchanged. Adding

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this additional independent variable does, however, shift upward the level of per capita income at which the slowdown is predicted to occur, other things equal, to the US$ 18,569–18,973 range.

Tables 4.2, 5, and 6 show that these patterns are robust to a variety of changes in sample and specification. Table 4.2 retains the entire string of years identified by the slowdown methodology (when these exist) rather than using a Chow test to pick out an individual year. Tables 5.1 and 5.2 use the Chow test and consecutive-year definitions but employ the entire sample of countries rather than just those for which manufacturing employment is available. Tables 6.1 and 6.2 do the same but remove oil exporters from the sample. There are a few differences worth noting. When we include the entire string of slowdown years (Table 4.2), a higher fertility rate is positively and significantly associated with the probability of a growth slowdown. In this variant, slowdowns begin at lower levels of per capita GDP (US$ 12,802 in Table 2) and at a lower ratio of per capita income relative to the lead economy (0.54 rather than 0.58).

5. Extensions

Our preferred results are those in Tables 6.1 and 6.2, where the sample includes as many countries as possible other than oil exporters. We now use these tables as a basis for considering the impact, if any, of other country characteristics and policies.

For example, one might conjecture that authoritarian regimes are more or less prone to growth slowdowns than democracies, or that countries experiencing a shift in political regime in one direction or the other are more vulnerable to slowdowns.[13] Financially open economies might be more prone to growth slowdowns insofar as they are exposed to capital flow reversals or less prone to slowdowns insofar as they can successfully finance investment externally. Trade openness might reduce the likelihood of experiencing a slowdown (or so cases like Hong Kong and Singapore suggest), whereas terms of trade shocks might increase that likelihood.[14] Old-age

13 Again following Hausmann, Pritchett, and Rodrik (2005), political regime change is defined as one if during a 5-year period the regime change increases ("Poschange") or reduces ("Negchange) the policy score.

14 Trade openness and its squared term. Trade openness is measured by "constant price openness" as defined in the PWT: (exports + imports) / (GDP in constant prices). Financial openness index constructed by Chinn and Ito (2008), with updates kindly supplied by the authors. For terms of trade shocks, we followed Hausmann, Pritchett and Rodrik (2005), defining a dummy variable denoted *TOT,* which takes a value 1 whenever the change in the terms of trade from year t to $t - 4$ is in the lower 10 percent of the entire sample. This variable captures exceptionally adverse external circumstances.

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Table 5. Determinants of growth slowdowns for entire sample

Table 5.1. Determinants of growth slowdowns for entire sample, probit model using Chow test points

	Growth slowdown			
	(1)	**(2)**	**(3)**	**(4)**
Per capita GDP	19.66**		29.93**	25.74**
	(4.46)		(7.65)	(6.24)
Per capital GDP^2	−0.98**		−1.55**	−1.31**
	(0.23)		(0.43)	(0.33)
Ratio		3.06**	0.76	
		(0.50)	(1.26)	
Ratio^2		−0.90**	0.10	
		(0.26)	(0.15)	
Dependency				−0.06
				(0.04)
Dependency^2				0.00
				(0.00)
Fertility				0.26*
				(0.11)
Pseudo R-square	0.35	0.27	0.35	0.36
Observations	4,246	4,246	4,246	3,931
Country	128	128	128	126

Source: *Authors' calculations.*

Note: *The sample covers all the countries. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

Table 5.2. Determinants of growth slowdowns for entire sample, probit model using consecutive points

	Growth slowdown			
	(1)	**(2)**	**(3)**	**(4)**
Per capita GDP	21.97**		30.58**	28.32**
	(5.20)		(8.69)	(7.05)
Per capital GDP^2	−1.10**		−1.56**	−1.44**
	(0.27)		(0.48)	(0.37)
Ratio		3.48**	0.08	
		(0.55)	(1.57)	
Ratio^2		−1.04**	0.20	
		(0.28)	(0.20)	
Dependency				−0.10
				(0.06)
Dependency^2				0.00
				(0.00)
Fertility				0.32*
Pseudo R-square	0.42	0.32	0.42	0.43
Observations	4,85	4,85	4,85	4,49
Country	128	128	128	126

Source: *Authors' calculations.*

Note: *The sample covers all the countries. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

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Table 6. Determinants of growth slowdowns for non-oil countries

Table 6.1. Determinants of growth slowdowns for non-oil countries, probit model using Chow test points

	Growth slowdown												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Per capita GDP	48.19**		50.53**	60.63**	60.83**	61.63**	62.59**	60.59**	60.05**	60.63**	54.07**	75.58**	77.27**
	(13.25)		(12.52)	(13.96)	(14.33)	(17.04)	(15.35)	(13.44)	(15.36)	(15.98)	(17.98)	(12.25)	(11.54)
Per capital GDP^2	−2.47**		−2.12**	−3.08**	−3.08**	−3.14**	−3.17**	−3.07**	−3.05**	−3.06**	−2.79**	−3.84**	−3.93**
	(0.70)		(0.63)	(0.73)	(0.75)	(0.88)	(0.80)	(0.70)	(0.80)	(0.84)	(0.95)	(0.64)	(0.60)
Pre-slowdown growth				35.03**	39.19**	51.96**	36.70**	37.50**	40.91**	38.13**		42.53**	43.50**
				(4.75)	(5.77)	(10.29)	(5.31)	(6.10)	(7.45)	(5.53)		(7.83)	(7.54)
Ratio		9.88**	−29.03										
		(1.67)	(17.50)										
Ratio^2		−6.87**	10.41										
		(1.58)	(7.09)										
Dependency					0.17								
					(0.12)								
Dependency^2					−0.00								
					(0.00)								
Old dependency						0.29							
						(0.16)							
Old dependency^2						−0.01							
						(0.01)							
Young dependency						0.06							
						(0.11)							
Young dependency^2						−0.00							
						(0.00)							
Fertility							0.14						
							(0.16)						
Trade openness in constant prices								0.02	−0.24				−0.49
								(0.53)	(0.50)				(0.62)
Trade openness in constant prices^2								−0.05	0.04				0.11
								(0.16)	(0.15)				(0.21)
Financial openness										−0.10			
										(0.10)			

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Table 6.1. ***(Continued)***

	Growth slowdown												
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
Terms of trade									0.56				
									(0.52)				
Positive political change											−0.08		
											(0.21)		
Negative political change											0.24		
											(0.27)		
Consumption share of per capita GDP												−28.31**	−31.33**
												(6.72)	(7.02)
Consumption share of per capita GDP^2												24.46**	26.76**
												(5.41)	(5.71)
Investment share of per capita GDP												6.90	6.16
												(7.20)	(8.63)
Investment share of per capita GDP^2												−14.02	−13.69
												(8.60)	(11.43)
Government share of per capita GDP												8.68	6.10
												(6.99)	(7.24)
Government share of per capita GDP^2												−25.45	−20.04
												(17.41)	(18.09)
Pseudo R-square	0.42	0.36	0.43	0.53	0.54	0.56	0.53	0.53	0.53	0.56	0.43	0.55	0.56
Observations	3,833	3,833	3,833	3,512	3,349	3,349	3,152	3,512	2,495	2,500	3,103	3,512	3,512
Country	116	116	116	114	114	114	114	116	96	113	111	116	116

Source: *Authors' calculations.*

Note: *The sample covers all except for oil countries. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

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Table 6.2. Determinants of growth slowdowns for non-oil countries, probit model using consecutive points

	Deceleration												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Per capita GDP	56.86**		58.07**	78.48**	83.68**	79.11**	83.40**	78.32**	82.93**	84.53**	64.30**	88.86**	93.75**
	(14.23)		(14.09)	(16.55)	(20.92)	(21.49)	(19.10)	(16.75)	(22.94)	(19.86)	(20.00)	(15.78)	(14.29)
Per capital GDP^2	−2.93**		−2.30**	−4.00**	−4.27**	−4.05**	−4.25**	−4.00**	−4.24**	−4.28**	−3.33**	−4.55**	−4.81**
	(0.75)		(0.73)	(0.87)	(1.10)	(1.12)	(1.00)	(0.88)	(1.20)	(1.04)	(1.05)	(0.83)	(0.75)
Pre-slowdown growth				50.09**	53.50**	66.81**	55.51**	48.61**	55.87**	59.13**		46.82**	47.59**
				(5.50)	(6.15)	(9.47)	(6.29)	(6.21)	(7.15)	(7.45)		(8.95)	(8.51)
Ratio		13.67**	−41.33										
		(2.33)	(21.86)										
Ratio^2		−10.17**	14.11										
		(2.15)	(8.60)										
Dependency					−0.05								
					(0.09)								
Dependency^2					0.00								
					(0.00)								
Old dependency						0.29*							
						(0.14)							
Old dependency^2						−0.01							
						(0.00)							
Young dependency						0.03							
						(0.08)							
Young dependency^2						−0.00							
						(0.00)							
Fertility							0.09						
							(0.23)						
Trade openness in constant prices								−0.65	−2.72*				−1.36
								(0.71)	(1.14)				(0.91)
Trade openness in constant prices^2								0.25	1.41*				0.55
								(0.23)	(0.61)				(0.33)

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Table 6.2. ***(Continued)***

	Deceleration												
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
Financial openness										−0.16			
										(0.12)			
Terms of trade									−0.02				
									(0.54)				
Positive political change											0.19		
											(0.27)		
Negative political change											0.34		
											(0.33)		
Consumption share of per capita GDP												−25.59*	−32.93**
												(10.23)	(11.16)
Consumption share of per capita GDP^2												21.47**	27.05**
												(8.24)	(9.30)
Investment share of per capita GDP												9.50	18.63
												(7.78)	(10.81)
Investment share of per capita GDP^2												−15.18	−31.97*
												(10.19)	(15.90)
Government share of per capita GDP												−1.06	−0.61
												(8.51)	(9.18)
Government share of per capita GDP^2												−7.06	−10.01
												(19.56)	(21.40)
Pseudo R-square	0.50	0.44	0.51	0.65	0.65	0.67	0.66	0.65	0.68	0.69	0.51	0.66	0.67
Observations	4,120	4,120	4,120	3,770	3,599	3,599	3,497	3,770	2,632	2,665	3,295	3,770	3,770
Country	116	116	116	114	114	114	114	116	96	113	111	116	116

Source: *Authors' calculations.*

Note: *The sample covers all except for oil countries. Numbers in parenthesis are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

and youth dependency rates might have different implications. At the same time, the fact that a number of these variables (the nature of the political regime or trade and financial openness) have been shown to be less than robustly related to economic growth suggests that they might also be less than robustly related to sharp (negative) changes in economic growth of the sort we analyze here.

It is this last presumption that appears to be borne out. Financial openness, terms of trade shocks, and political regime changes do not appear to have a significant impact on the likelihood of growth slowdowns.[15]

Higher old-age dependency rates, in contrast, do appear to increase the likelihood of a slowdown, which is intuitive insofar as it is associated with lower savings rates and slow labor force participation rates (Table 6.2, column [6]). Note that distinguishing the old-age and youth dependency ratios, as we have done here, also eliminates the anomaly of a positive coefficient on the fertility rate seen in some columns of Tables 4.1 and 4.2.

The estimates for trade openness, although not entirely consistent, do provide some support for the hypothesis, at least when openness is entered together with terms of trade shocks. In Table 6.2, both the linear and squared terms in openness are statistically significant at the 1 percent confidence level. Economies more open to trade are less likely to experience slowdowns, other things equal, where the presence or absence of terms of trade shocks is important among the other things that must be held equal. This effect reaches a peak when exports and imports as a share of GDP approach 96 percent. This result is consistent with Kehoe and Ruhl (2010), who argue that trade openness is more important during the early stage of growth and institutions become more important at the later stages.

This brings us back to the cases of Hong Kong and Singapore, small open economies that seem to have slowed down at much higher than average incomes. When we add a variety of measures of economic size—aggregate GDP or population, for example—they appear to have no effect on the likelihood of experiencing a slowdown. If these economies are unusual, it would appear that this is because they are so open, not because they are so small. Note, however, that the sum of exports and imports is considerably above 96 percent in both economies, which suggests that

15 Failure to find effects for financial openness could conceivable reflect the fact that the Chinn-Ito index starts in 1970 for most countries (except Bahrain [1976], Hungary [1986], Mauritius [1972], Oman [1977] and the United Arab Emirates [1976]). This forces us to drop earlier growth slowdowns like those of Australia (1968), Austria (1961), Demark (1964, 1965), Greece (1969), Ireland (1969), Japan (1967–69), New Zealand (1960, 1965, 1966), Spain (1969), and the United States (1968).

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other factors (economic policies and proximity to China are plausible candidates) also account for their exceptional behavior.

One might also ask whether slowdowns are more likely in high-investment, high-consumption, or high-government-spending economies. We therefore examine the impact of the ratios of these variables to GDP, where the ratio in question is entered in both level and squared form.[16] Only the consumption share and its square are consistently significant. The consumption ratio enters negatively: as consumption rises from low levels, the probability of a slowdown falls. The probability of slowdown is minimized when consumption is 62 or 64 percent of GDP (Table 6.1 or 6.2, respectively). In addition, there is some evidence that the investment ratio matters for the probability of growth slowdowns: slowdowns are less likely in countries that maintain exceptionally high investment rates, other things equal (the quadratic of the investment rate is negative and significant in Table 6.2, column [13]).

6. Effects of economic policy

How is the probability of experiencing a growth slowdown affected by economic policy? We take a first cut at answering this question by adding to our basic model, which takes per capita income, per capita income squared, and the pre-slowdown rate of growth as key regressors, the average rate of inflation from $t - 7$ to $t - 1$, the variability of that inflation rate (calculated as the standard deviation of past inflation over the same period), and the variability of the exchange rate (calculated as the standard deviation of the nominal exchange rate over the same period).

In addition, we include the undervaluation of the real exchange rate over the same 7 years. The real exchange rate is defined as the nominal exchange rate (e) relative to PPP: $RER = e/PPP$. We compute the "normal" or "equilibrium" real exchange rate for a large sample of countries, regressing the real exchange rate on per capita GDP, demographic controls, and a vector of time dummies. The extent of real over or undervaluation is then the difference between the actual real exchange rate and the fitted value.[17]

Tables 7.1 and 7.2 show our results. The most consistently significant policy variable is the degree of real undervaluation.[18] Strikingly, this enters positively: countries

16 Note that we continue to control for per capita income and other characteristics.

17 Nothing changes when we exclude the measures of demographic structure from the first part of this exercise.

18 In addition, there is some indication that a more variable exchange rate heightens the risk of a slowdown (exchange rate variability is statistically significant in one of the two tables).

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with more dramatically undervalued currencies are more likely to experience growth slowdowns, other things equal. This is more than simply the tendency for real undervaluation to translate into faster output growth, because we are controlling separately for the pre-slowdown growth rate. It may be that countries that rely on undervalued exchange rates to boost economic growth are more vulnerable to external shocks resulting in sustained slowdowns. It may be that real undervaluation works as a mechanism for boosting growth during the early stages of development when a country relies on shifting labor from agriculture to export-oriented manufacturing but not in subsequent stages when growth becomes more innovation intensive, but governments are reluctant to abandon the earlier policy strategy, leaving the economy increasingly susceptible to slowing down. It could be that real undervaluation allows imbalances and excesses in export-oriented manufacturing build-up, as seen in Korea in the 1990s, through that channel making a sustained deterioration in subsequent growth performance more likely.

An alternative approach to analyzing the impact of economic policies is by estimating a hazard model. The dependent variable in the typical hazard model is the duration of time until an event occurs. In our model, however, the dependent variable is per capita GDP. The idea is that because the probability of growth slowdown increases with per capita GDP, we can treat per capita GDP in the same way as duration of time in the typical model. In this setup, the estimated coefficients indicate the impact of the regressors on the hazard rate of slowdown at the corresponding per capita GDP level. We removed countries that never have experienced slowdown and those with per capita GDPs above US$ 20,000.[19] For countries that never experience a growth slowdown, but with per capita GDPs below US$ 20,000, we use their per capita GDP in year 2000, this being the last year we can calculate the 7-year post-slowdown growth rate. Table 8.1 considers only the first slowdown for each country, and Table 8.2 allows for multiple slowdowns. In the latter case we allow for clustering effects when estimating the standard errors. In estimating the model, we also removed oil countries.

The results again suggest that countries with undervalued real exchange rates are more vulnerable to slowdowns. In addition there is now some indication in this specification that policy instability—high and variable inflation rates—are precursors to slowdowns. In the consolidated specification in the last column of Table 8.1, both the level and variability of inflation enter with significant negative coefficients,

19 The reason for removing these countries is that the United States experienced growth slowdown when its per capita GDP is US$ 19,496, and it is unlikely that a country never experiences a slowdown until that level.

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Table 7. Effects of economic policy

Table 7.1. Effects of economic policy, Chow test points

	Deceleration				
	(1)	(2)	(3)	(4)	(5)
Per capita GDP	55.38**	57.60**	62.29**	60.00**	65.34**
	(14.64)	(15.60)	(14.75)	(15.93)	(18.69)
Per capital GDP^2	−2.81**	−2.92**	−3.17**	−3.02**	−3.31**
	(0.77)	(0.82)	(0.77)	(0.83)	(0.98)
Pre-slowdown growth	35.92**	36.94**	36.29**	36.81**	41.02**
	(5.71)	(5.92)	(4.92)	(4.94)	(6.17)
Inflation	−0.00				−0.20
	(0.06)				(0.30)
Inflation variability		0.01			0.13
		(0.04)			(0.18)
Exchange rate variability			−0.01		−0.02
			(0.01)		(0.01)
Undervaluation of real exchange rate				1.25*	0.73
				(0.60)	(0.76)
Pseudo R-square	0.51	0.51	0.53	0.55	0.55
Observations	2,880	2,603	3,485	3,293	3,293
Country	109	104	115	114	104

Source: *Authors' calculations.*

Note: *The sample covers all except for oil countries. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

Table 7.2. Effects of economic policy using consecutive points

	Deceleration				
	(1)	(2)	(3)	(4)	(5)
Per capita GDP	75.27**	75.38**	77.82**	78.60**	74.31**
	(17.64)	(18.18)	(16.93)	(18.94)	(18.10)
Per capital GDP^2	−3.84**	−3.84**	−3.96**	−3.97**	−3.76**
	(0.93)	(0.95)	(0.89)	(0.99)	(0.95)
Pre-slowdown growth	56.67**	56.01**	49.91**	56.01**	57.48**
	(7.00)	(6.86)	(5.66)	(5.67)	(6.41)
Inflation	0.06				0.01
	(0.05)				(0.39)
Inflation variability		0.04			0.05
		(0.04)			(0.27)
Exchange rate variability			0.00**		0.00**
			(0.00)		(0.00)
Undervaluation of real exchange rate				1.57**	1.35*
				(0.60)	(0.63)
Pseudo R-square	0.65	0.64	0.65	0.68	0.68
Observations	3,071	2,786	3,740	3,543	3,543
Country	109	104	115	114	104

Source: *Authors' calculations.*

Note: *The sample covers all except for oil countries. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

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Table 8. Hazard model of growth slowdown

Table 8.1. Hazard model of growth slowdown, initial slowdowns only

	Slowdown hazard				
	(1)	(2)	(3)	(4)	(5)
Inflation	0.321 (0.223)				10.551** (2.377)
Inflation variability		0.103 (0.147)			−9.602** (2.204)
Exchange rate variability			−0.011 (0.013)		0.002 (0.002)
Undervaluation of real exchange rate				3.036** (0.942)	3.038** (1.062)
Alpha	4.128** (0.121)	4.154** (0.125)	4.107** (0.111)	4.318** (0.123)	4.454** (0.155)
Observations	100	93	107	105	92

Source: *Authors' calculations.*

Note: *The duration is measured in per capita GDP. Numbers in parentheses are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

Table 8.2. Hazard model of growth slowdowns using multiple slowdowns

	Slowdown hazard				
	(1)	(2)	(3)	(4)	(5)
Inflation	0.286 (0.210)				7.947** (2.475)
Inflation variability		0.087 (0.136)			−7.127** (2.356)
Exchange rate variability			−0.007 (0.015)		0.001 (0.001)
Undervaluation of real exchange rate				0.914 (0.675)	2.418* (1.024)
Alpha	4.097** (0.102)	4.115** (0.107)	4.077** (0.092)	4.148** (0.095)	4.326** (0.136)
Observations	107	98	116	114	97

Source: *Authors' calculations.*

Note: *The duration is measured in per capita GDP. Numbers in parenthesis are robust standard errors. *Statistically significant at the 5 percent level. **Statistically significant at the 1 percent level.*

suggesting that in these countries slowdowns come at lower per capita incomes. The results in Table 8.2 reinforce the finding.

7. Implications for China

Although an eventual growth slowdown is common to all fast-growing economies, special anxiety attaches to the question of how and when Chinese growth might slow. China in recent years has accounted for a substantial fraction of global growth.

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A sharp slowdown in Chinese growth in the not-too-distant future could therefore have important implications for global expansion. In China itself, there could be implications for social stability. On both counts the ramifications could be far-reaching.

A few earlier studies have contemplated this question. Lee and Hong (2010) use a growth accounting framework distinguishing capital, labor, and human capital, and estimate equations for TFP growth, the growth of the capital/labor ratio, and the savings rate for a panel of countries. These variables depend on their own past levels.[20] Other exogenous drivers include years of schooling and the growth of the stock of patents in the case of TFP growth, demographic variables, openness, and the strength of property rights in the case of the growth of the capital/labor ratio, and demography variables in the case of the savings rate. China being an outlier with its especially rapidly growing capital/labor ratio, a dummy variable for the People's Republic of China is included in some variants of that equation, generating alternative forecasts for the countries' future growth performance.

Inserting plausible projections for the exogenous drivers, the authors project China as growing in the aggregate by 6.1 to 7.0 percent per annum in the 2011–20 decade and 5.0 to 6.2 percent in the 2021–30 decade.[21] This suggests that China will experience a slowdown, as defined by our criteria in this paper, sometime in the next 10 years.[22] From an accounting perspective, this reflects slower growth of all four proximate determinants of the aggregate rate of growth: slower labor force growth, a slower increase in educational attainment, a slower rate of increase in the capital stock and, most importantly, a slowdown in the country's rapid rate of TFP growth heretofore. From an economic standpoint, slower growth results from the convergence of TFP and the capital/labor ratio to advanced-country values, slower growth of educational attainment once school enrollment rates have reached reasonably high levels, and ageing of the population.

These findings are broadly in line with the conclusions of other similar studies. Taking the midpoints of Lee and Hong's estimates yields a forecast of 6.1 percent per annum over the 2011–30 period. Wilson and Stupnytska (2007), in a study adopting a simplified version of the same methodology, produced an estimate of 5.8 percent for 2008–30. Maddison (2007) is more pessimistic, forecasting China's an-

20 Thus, the rate of TFP growth is negatively related to its initial level, just as the growth of the capital/labor ratio is negatively related to its past level.

21 Or 5.8 and 5.1 percent, respectively, in per worker terms.

22 The differences within each period reflect different assumptions about the evolution of investment in education, the growth of the stock of patents, and the strength of property rights.

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nual average growth as slowing to 5.0 percent between 2004 and 2030.[23] Buiter and Rahbari (2011), relying heavily on the historical relationship between growth and convergence, project growth of per capital income of 5.0 percent between 2010 and 2050 and, by implication, slightly faster growth of overall GDP.

Fogel (2007) projects aggregate Chinese growth as running at 8.4 over the longer period 2001–40. He bases his projections largely on the evolution of demographic trends and with optimistic assumptions about the returns to further investment in education. Although the other papers all imply that a significant growth slowdown is coming, the implications of Fogel's study, in this respect, are less clear. Given actual performance in the most recent decade, his figures imply a downshift to 7.9 percent per annum growth in the course of the next three decades. If this downshift occurs abruptly, it would just barely constitute a slowdown according to our criteria, but spread over three decades it would not. The Conference Board (2010) offers a base scenario in which growth proceeds by 9.2 percent per annum in 2010–15 and 7.9 percent per annum in 2015–20, by our metric avoiding a slowdown. But it also offers a pessimistic scenario in which the economy's growth slows first to 6.1 percent per annum and then to 3.9 percent per annum between the first and second halves of the current decade.

Our results can be used to address the question of whether an abrupt slowdown is likely and if so, when. Both China's openness and high investment rate point away from the likelihood of a slowdown. Other considerations, however, suggest that a slowdown may be coming sooner rather than later. Recall that they suggest that the probability of a slowdown is highest when per capita GDP reaches US$ 16,740 (year 2005 international PPP) dollars, when the ratio of per capita income to that in the lead country is 58 percent, and when the share of employment in manufacturing reaches 23 percent. In Table 3.2 we see that China's per capita GDP is US$ 8,511 and the ratio of China's per capita GDP to that in the United States is 19.8 percent in 2007. If China grows at 9.3 percent, which is the average growth rate of per capita GDP for the most recent 10 years in the PWT (1998–2007), by 2015 China's per capita GDP reaches US$ 17,335, just exceeding our slowdown threshold. If China grows more modestly at 7 percent, then per capita GDP reaches the threshold level in 2017.[24]

If the probability of slowing down is thought to depend on the country's GDP per capita relative to that in the lead country (the United States), forecasts for

23 Maddison's forecasts are purely judgmental; they are not grounded in an explicit model.

24 All projections are for GDP in PPP (international prices).

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U.S. growth also matter. If the United States grows at 1.9 percent per annum, the average growth rate of per capita GDP in 1998–2007, then the ratio of Chinese to U.S. GDP per capita will still be only 35 percent in 2015 even if China grows at 9.3 percent. But if the current financial crisis substantially slows the U.S. growth rate to 1 percent through 2015, then the ratio increases to 37 percent. Either way, this remains well below the 58 percent ratio which, historically, has been the point where fast-growing catch-up economies slow down. If we assume 9.3 percent Chinese growth and 1.9 (1.0) U.S. growth, then China reaches 58 percent of U.S. per capita income in 2023 (2021).

China's share of manufacturing in total employment was 11.3 percent in 2002, the latest year for which data are available.[25] In the absence of further figures we assume that this fraction has been growing at 1 percent per annum. If this is right, it suggests that the share of employment in manufacturing is now within hailing distance of the 23 percent where historical comparisons suggest that growth slows down.

Our results further suggest that the fact that Chinese growth has been unusually fast, that its growth has been associated with what is widely viewed as a chronically undervalued exchange rate, that the old-age dependency ratio is rising, and that the consumption share of GDP is exceptionally low heightens the likelihood of an imminent slowdown. Raising the growth rate from 5 to 10 percent, the difference between the emerging market average and China, raises the probability of a slowdown by 38 to 71 percent (depending on whether we use estimates based on Chow-test break points or the consecutive slowdown points). Assuming that the renminbi is undervalued by 46 percent (the estimate we obtain from the real exchange rate regression in this paper) raises the probability of a slowdown by 22 percentage points to 71 percent. That the consumption share of GDP is 48 percent rather than 64 percent (the latter, recall, being the ratio that minimizes the likelihood of slowing down) raises the probability of a slowdown by 16 percentage points to 73 percent. The fact that China's old-age dependency ratio is 10.1 percent rather than 9.4 percent raises the probability of a slowdown by 3.5 percentage points to 77 percent. Finally, the fact that China's inflation rate has been rising heightens the likelihood of a slowdown, other things equal.

We can use a selection of our estimated equations together with 2007 values of the independent variables to estimate the likelihood of a Chinese slowdown. Using the

25 We obtained this figure from the National Bureau of Statistics (NBS) of China. The most recent data for the manufacturing employment share are for 2002. After that the NBS reports the employment share for "secondary industry," a category that includes other sectors in addition to manufacturing industries.

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coefficients in Table 6.2, columns (6) and (13), where the key independent variables are per capita income, the pre-slowdown rate of growth, demographic structure (in column [6]), trade openness and the composition of spending (in column [13]) puts the probability at 77 percent and 73 percent. Table 7.2, column (5), where the independent variables are policy measures (inflation, inflation variability, and real undervaluation), this procedure puts the probability of a slowdown at 71 percent. These are certainly non-negligible odds.[26]

One should of course exercise special caution when extrapolating to China from the experience of other countries. Never before has such a large country grown so fast for such an extended period. China's huge size and geographical diversity differentiate it from earlier fast growers such as Japan, Korea, and Taiwan. Coastal regions such as the Pearl River Delta and Zhejiang have substantially outperformed central and western regions up to now. The latter therefore remain further below the per capita income threshold for slowdowns. If the growth miracle is transplantable within China, then the economic development of the interior provinces, which have larger populations than most countries and are home to a substantial fraction of China's own population, can continue to sustain the country's growth for years to come. The government is already extending physical infrastructure, such as highways and railways, to less-developed provinces to prepare them for this transition.

There are China-specific downside risks to consider as well. These include the possibility of financial instability. They include social instability arising from large and growing inequality (see Woo [forthcoming]). To be sure, neither financial nor social instability is unique to China. Nor is their association with growth slowdowns: South Korea, for example, experienced social instability in the late 1980s and financial instability in the late 1990s, the years bracketing that county's growth slowdown. Still, the broader point of the importance of considering China's own unique structural characteristics when assessing the country's growth prospects continues to apply.

How do our results relate to the debate over rebalancing the Chinese economy? The empirical association between low levels of consumption and an undervalued exchange rate on the one hand and a relatively high probability of a slowdown on the other reinforces a point made by foreign commentators and Chinese officials alike that the process of rebalancing the economy away from exports and allowing the renminbi exchange rate to appreciate from its historically low levels is best initiated sooner (while Chinese growth is strong and other preconditions for its maintenance

26 Were we to possess 2011 rather than 2007 values of all of the independent variables, the predicted probability of a slowdown would presumably be higher still.

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are still in place) than later (when those shifts are more likely to be sharply discontinuous and disrupt the growth process). For example, one suspects that an economy that is unusually dependent on investment and net exports (and insufficiently dependent on domestic consumption) may be vulnerable to a sudden drop in the marginal efficiency of investment or a disruption to its foreign market access, either of which could be severely disruptive to the old growth model. Better, it follows, to start the process of eliminating those imbalances and limiting the danger of such disruptions while the going is good.[27]

8. Conclusion

We have now grown accustomed to a world of exceptionally rapid catch-up growth in late-developing countries. China and other emerging markets have come to account for the majority of the growth of global demand, and the consensus is that they will continue to do so going forward.[28] Economies as geographically and economically diverse as Germany and South Korea have come to depend on rapidly growing catch-up economies for incremental demand for their exports. That incomes in these countries will continue to rise and that the marginal propensity to spend on foodstuffs is higher at low and middle incomes is reason to think that higher food prices are here to stay. That emerging markets like China are energy-intensive economies suggests that current upward pressure on commodity prices is more than a passing phase.

This perspective is based on extrapolating the experience of the current cohort of high-growth economies. But there is also another, very different way of extrapolating historical experience: looking at earlier rapidly growing catch-up economies suggests that all fast-growing economies eventually slow down. The question is when. And the most immediate incarnation of the question is "when China?"

As with all things economic, forecasting growth slowdowns is an imperfect science. International experience suggests that rapid-growing catch-up economies slow

27 The fact that it may take considerable time to raise the consumption share of GDP to the middle-income-country norm, for the simple reason that it may take time to build a social safety net, develop financial markets, and undertake the other reforms necessary to limit precautionary saving, works in the same direction.

28 By some estimates, China alone is accounting for 30 percent of global demand growth, Brazil, Russia, India, and China account for 45 percent collectively, and emerging markets and developing countries as a whole a healthy majority of the total. Looking forward, the Conference Board (2010) suggests in its base case scenario that emerging markets will account for 3.4 percent of the global economy's 4.4 percent annual rate of economic growth over the coming decade.

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down significantly, in the sense that the growth rate downshifts by at least 2 percentage points, when their per capita incomes reach around US$ 17,000 in year-2005 constant international prices, a level that China should achieve in or soon after 2017, assuming that growth between now and then continues at the rates recently achieved. Our estimates suggest that high growth slows down when the share of employment in manufacturing is 23 percent; although current data on employment shares in China are not readily available, observation and extrapolation suggest that China is nearly there. Our estimates similarly suggest that growth slows when income per capita in the late-developing country reaches 57 percent of that in the country that defines the technological frontier, a level that China is likely to reach only somewhat later.

Of course, there is no iron law of slowdowns. A mechanical relationship between per capita incomes and growth slowdowns is unlikely. How long rapid growth is successfully maintained depends also on economic policy. Economies that are more open to trade seem to be able to maintain high growth rates for longer; this will reassure those who hope that China will be able to continue driving global growth. But higher old-age dependency ratios make growth slowdowns more likely, and China will have a higher old-age dependency ratio in the not-too-distant future. Higher and more volatile inflation rates also make slowdowns more likely, and there are reasons to worry about China on this score.

Most provocatively, slowdowns are more likely and occur at lower per capita incomes in countries that maintain undervalued exchange rates and have low consumption shares of GDP. The nature of this association remains, at this point, a matter of speculation. It could be that countries that rely on undervalued exchange rates are more vulnerable to external shocks. It may be that real undervaluation that works well as a mechanism for boosting growth in the early stages of development works less well later, when growth becomes more innovation-intensive. It may be that real undervaluation allows imbalances and excesses in export-oriented manufacturing build-up.

More generally, our results suggest that an exceptionally low consumption share of GDP is positively associated with the probability of a slowdown. This is more than simply the same real-undervaluation result in another guise. Although an undervalued exchange rate may be a driver of China's imbalances, it is by no means the only one. In fact, a wide range of factor price distortions favors the production of tradables over nontradables and thereby results in an unusually low consumption share of GDP. Lax corporate governance of state-owned enterprises limits pressure to pay out dividends and acts as a de facto subsidy for investment. The absence of a

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social safety net and well-developed domestic financial markets provide a strong incentive for precautionary saving on the part of households. This suggests additional margins on which Chinese policy can operate to limit the risk of a sharp growth slowdown.

In some circles, the assumption is pervasive that China will continue to grow rapidly. Equivalently, it is assumed that China will be able to avoid the middle-income trap and jump to upper-middle-income-country status. But it is worth recalling that only a small group of countries successfully completed this transition in the second half of the 20th century, whereas a much larger group, in Latin America for example, are still struggling to escape the middle-income trap. Given China's huge size and daunting array of structural challenges, completing this transition is far from a fait accompli.

Appendix

1. Growth Slowdown
   Per capita GDP: Real GDP per capita (US$ in 2005 Constant Prices: Chain series).
   Source: Penn World Tables 6.3.
2. Growth Accounting
   (1) Aggregate GDP
   Per Capita GDP × Population.
   Source: Penn World Tables 6.3.
   (2) Labor Force
   Working Age Population between 15 and 64 years.
   Source: World Development Indicators 2010.
   For Taiwan, we use actual labor force from National Statistics of Taiwan.
   (3) Capital
   Authors' calculations based on investment data.
   (4) Labor Share
   Source: Bernanke & Gurkaynak (2001).
   (5) Human Capital
   Educational Attainment for Population aged 25 years and over.
   Source: Barro and Lee (2010) Educational Attainment Data set.
3. Probit Regression
   (1) Demography
   - Age Dependency Ratio, young: Percentage ratio of younger dependents (younger than 15 years) to the working-age population (15–64 years).
     Source: World Development Indicators 2010.

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- Age Dependency Ratio, old: Percentage ratio of older dependents (older than 64 years) to the working-age population.
  Source: World Development Indicators 2010.
- Age Dependency Ratio: The percentage ratio of dependents (people younger than 15 years or older than 64 years) to the working age population.
  Source: World Development Indicators 2010.
- Fertility Rate: Birth per woman.
  Source: World Development Indicators 2010.

(2) Manufacturing employment share.
Source: EUKLEMS.
(3) External sector

- Terms of Trade: Net barter terms of trade index calculated as the percentage ratio of the export unit value index to the import unit value index, measured relative to the base year 2000.
  Source: World Development Indicators 2010.
  The data before 1980 were obtained from Hiro Ito.
- Trade openness in constant prices: The total trade (exports and imports) as a percentage of GDP.
  Source: Penn World Tables 6.3.
- Financial Openness: The index takes on higher values the more open the country is to cross-border capital transactions.

(4) Political regimes

- Polity Index: The polity score captures the regime authority spectrum on a scale ranging from –10 (hereditary monarchy) to +10 (consolidated democracy).
  Source: The Center for Systemic Peace.
- Democracy Variable (Political rights): Political Rights are measured on a 1–7 scale, with 1 representing the highest degree of Freedom and 7 the lowest.
  Source: Freedom House.

(5) Policy Variables

- Inflation: CPI change over corresponding period of previous year.
  Source: IFS line 64XZF.
- Exchange Rate: US=1.
  Source: Penn World Tables 6.3.
- Real Exchange Rate: Exchange Rate divided by PPP.
  Source: Penn World Tables 6.3.
- Debt-to-GDP ratio: Total government debt as a percentage of GDP.
  Source: Reinhart and Rogoff (2010) data set.

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