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When Fast Growing Economies Slow Down: International Evidence and Implications for the People's Republic of China

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Barry Eichengreen, Donghyun Park, and Kwanho Shin

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Barry Eichengreen, Donghyun Park, and Kwanho Shin
June 2011

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Abstract

Using international data starting 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 \$17,000 in year-2005 constant international prices, a level that the People's Republic of 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.

I. Introduction

It is not an overstatement to say that 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 the People's Republic of China (PRC), extending now through much of Asia, and experienced increasingly in other parts of the developing world. Rapid economic growth, on the order of 10% 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 majority of the growth of global demand in recent years. The fast growth of emerging markets means also 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 economic realm.

That late-developing countries that have put a suitable policy framework in place have the capacity to grow more rapidly than early developers is something economists have known since at least Alexander Gerschenkron.² Rather than having to pioneer new technologies, late-developing countries can import know-how 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 and enjoying higher incomes than elderly dissavers, such countries are able to finance high levels of investment.

But, to invoke singer-songwriter 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 rural labor is drained. The share of employment in manufacturing peaks, and growth comes to depend more heavily on the more difficult process of raising productivity in the services 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.

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 See www.youtube.com/watch?v=4pBo-GL9SRg.

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 are the questions we focus on in the present paper.

The importance of the answers will be obvious. Significant growth slowdowns in, say, Brazil, the PRC, and India 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 intensity 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.

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

In addition, the large and fast-growing PRC 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 2008 global economic crisis: weakened household balance sheets, increased public debts, and still troubled financial systems. In contrast, the PRC 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%. Both advanced and developing countries benefited from the PRC’s resilience. Robust demand in the PRC lifted capital goods exports from Germany and Japan and commodity exports from Africa and Latin America. In particular, demand from the PRC contributed substantially to recovery in East and Southeast Asia, which has close trade linkages with the PRC.

Finally, while the PRC recovered faster than expected from the global crisis, its policy makers are grappling with how to sustain growth in the medium and long term. The postcrisis 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 the PRC’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 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 policy makers in the PRC. 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, the PRC faces other medium-term structural challenges, notably rapid population aging.

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 1950–1990 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, while for developing countries (Latin American countries in particular) many of the break points 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, commodity-exporting countries. Again, we are not concerned with episodes of stagnation, 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 radically than episodes of stagnation from the slowdowns that we seek to understand here.

The rest of the paper is organized as follows. Section II explains how we identify growth slowdowns. Section III then describes the characteristics of the resulting sample. Sections IV through VI then take various approaches to identifying the correlates and determinants of these slowdowns. Section VII attempts to draw out the implications for the PRC, while Section VIII concludes.

II. Identifying Growth 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:

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

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

⁴ Very small but statistically significant slowdowns qualify.

$$y_t > 10,000 \quad (3)$$

where y_t is per capita gross domestic product (GDP) in constant 2005 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, 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% 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 capita 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 \$10,000 in constant 2005 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 employ a Chow test for structural breaks and select only 1 year out of the consecutive years identified. For Greece we would 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, i.e., the dummy equals 1 for $t=t-1$, t and $t+1$ and 0 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 $t+2$, ... $t+7$ of the growth slowdown as a way of removing the transition period to which either a 0 or 1 may not be clearly assigned.

In addition to focusing on the dates identified above, we also report the results when we do not employ the Chow test and leave the consecutive years as they are, i.e., the dummy indicating a slowdown is set equal to 1 for the entire run of consecutive years (and, in addition to the observations for that country a 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

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).

when we employ the manufacturing share. Finally, since oil-exporting countries exhibit very volatile behavior and growth slowdowns at per capita incomes very different from other countries (see below), we also report the results when oil countries are removed. (In Table 1, oil exporters are shaded in yellow.) Throughout, we report robust standard errors that take into consideration the panel structure of the probit model.

Table 1: Growth Slowdown Episodes

Economy	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

continued.

Table 1: *continued.*

Economy	Year	Growth Before Slowdown (t – 7 through t) (%)	Growth After Slowdown (t through t + 7) (%)	Difference in Growth (%)	Per Capita GDP at t
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
	1978	6.5	4.5	-2.0	13,643
Hong Kong, China	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
	1978	4.7	0.8	-3.9	10,295
Hungary	1979	3.9	1.3	-2.6	10,244
	1972	9.4	-4.7	-14.0	10,690
Iran	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
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

continued.

Table 1: *continued.*

Economy	Year	Growth Before Slowdown (t – 7 through t) (%)	Growth After Slowdown (t through t + 7) (%)	Difference in Growth (%)	Per Capita GDP at t
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
	1990	8.6	5.8	-2.8	11,908
Korea, Republic of	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
	1993	6.7	-2.8	-9.5	44,043
Kuwait	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
	1983	9.3	-6.8	-16.1	10,081
Lebanon	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
	1977	5.8	-11.3	-17.1	56,246
Libya	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
	1994	6.7	3.4	-3.3	10,987
Malaysia	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
	1992	5.3	3.3	-2.0	11,183
Mauritius	1970	4.5	2.1	-2.4	17,387
Netherlands	1973	3.7	1.7	-2.0	18,642
	1974	3.5	0.9	-2.7	19,184
	1960	3.9	1.7	-2.2	12,406
New Zealand	1965	4.2	1.0	-3.2	14,456
	1966	4.6	1.3	-3.2	15,070
	1976	4.3	2.0	-2.3	21,849
Norway	1997	4.0	1.6	-2.4	39,503
	1998	4.1	1.7	-2.4	40,614

continued.

Table 1: *continued.*

Economy	Year	Growth Before Slowdown (t – 7 through t) (%)	Growth After Slowdown (t through t + 7) (%)	Difference in Growth (%)	Per Capita GDP at t
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
	1969	5.7	2.1	-3.6	10,094
Puerto Rico	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
	1977	9.4	-8.8	-18.2	43,032
	1978	5.5	-8.3	-13.8	37,541
Saudi Arabia	1979	3.7	-9.7	-13.4	40,696
	1978	6.9	4.8	-2.1	11,429
	1979	6.4	3.6	-2.8	12,369
Singapore	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
	1969	6.1	3.8	-2.3	11,262
	1972	5.2	1.7	-3.5	12,859
Spain	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
	1994	6.2	3.8	-2.4	16,053
	1995	6.0	3.6	-2.4	16,936
Taipei,China	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
	1978	4.6	-3.4	-8.1	12,959
Trinidad and Tobago	1980	3.6	-5.6	-9.3	13,671

continued.

Table 1: *continued.*

Economy	Year	Growth Before Slowdown (t – 7 through t) (%)	Growth After Slowdown (t through t + 7) (%)	Difference in Growth (%)	Per Capita GDP at t
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
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	16740

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 1 year that is most significant. The selected years by the Chow test are denoted in bold.

Source: Authors' calculation.

III. What Slowdowns Look Like

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

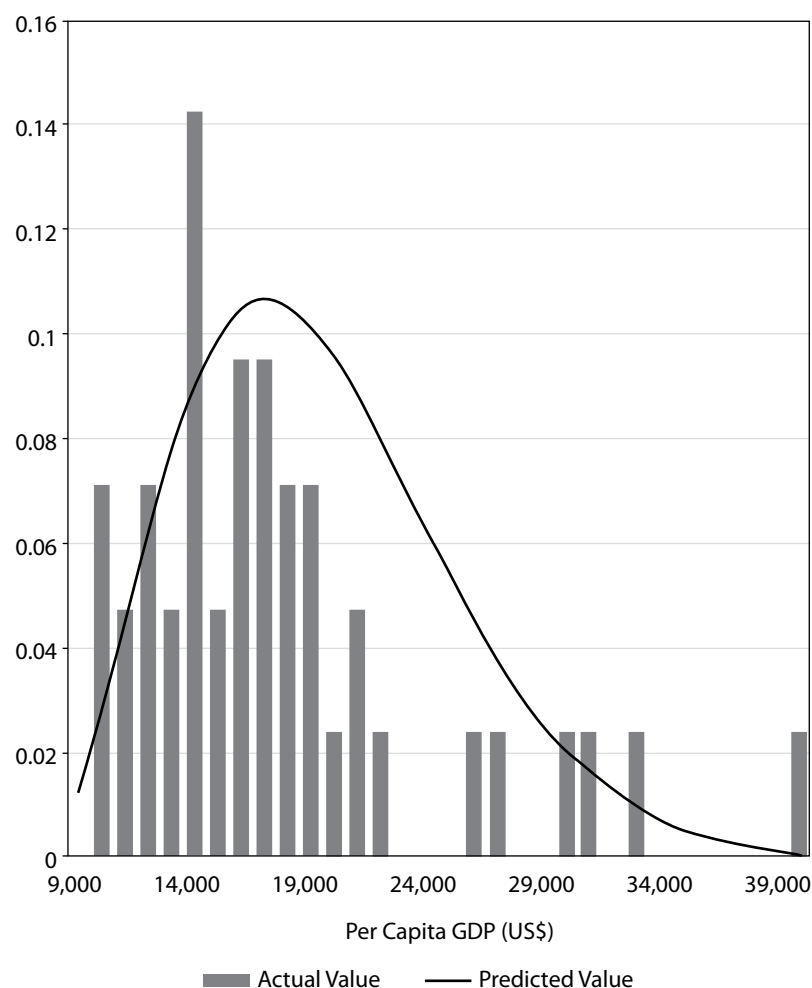
Around the average of \$16,740 there is considerable variation. Figure 1 summarizes the frequency distribution by per capita income in the form of a bar graph, oil exporters excluded.⁷ In some cases, explanations for these variations are well known, while in others explaining them "will require further 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

⁷ On the exclusion of oil exporters see the discussion below. The reader's eyes will no doubt be drawn to the four high-income slowdowns in the figure. These are for Hong Kong, China; Japan; Norway; and Singapore, all of which are discussed further in what follows.

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 the Republic of 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).

Figure 1: Frequency Distribution of Growth Slowdowns (oil exporters excluded)



GDP = gross domestic product.

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.

Source: Authors' calculation.

A number of countries do not appear in this list, for good reason. Most of these, like the PRC, continue to have per capita incomes below \$10,000 in constant 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 conjunctural

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 \$10,000 threshold to \$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 in order to repay its 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 Cuba's growth slowdown 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 \$16,740 to \$15,092 when we reduce the minimum-income threshold from \$10,000 to \$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% 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%). Obviously, these magnitudes are exceptional; there is no other country where slowdown episodes produce a cumulative deceleration of a full 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, China; Ireland; Israel; Norway; Portugal; and Singapore. 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. Very small open economies like Hong Kong, China 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.

⁸ Or at least adolescence.

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

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 a 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"), since 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% per annum over the 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.

IV. Proximate Source of Slowdowns

A first question as to why slowdowns occur is: 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 by, *inter alia*, 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*, while human capital data are from Barro and Lee (2010).

In Tables 2a and 2b we report two sets of growth accounting results, the first of which uses labor share calculated *à la* Bernanke and Gurkaynak, whereas the second simply sets labor's share equal to 0.65 for each country. In Table 2a we see that the contribution of the growth of the capital stock fell from 2.40% to 1.79% around the time of slowdowns. The contribution of labor growth fell more modestly, from 0.89% to just 0.86%, while that of the growth of human capital actually increased (from 0.44% to 0.51%). Much more dramatic is the decline in the contribution of total factor productivity (TFP) growth, from 3.04% to 0.09%. Growth slowdowns, in a nutshell, are productivity growth slowdowns.¹⁰ Around 85% 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 2b 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

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%–1.88% for capital, 0.91%–0.86% for labor, 0.45%–0.50% for human capital, and 2.83%–0.05% for TFP.

diminish. But the sharpness and extent of the fall in TFP growth from unusually high levels of 3% and higher to near zero is striking.

Next we consider the determinants of growth slowdowns using a probit model. Since 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.

Table 2a: Growth Accounting when Actual Labor Shares are Used (percent)

Economy	Year	Capital		Labor		Human Capital		Labor	
		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

continued.

Table 2a: continued.

Economy	Year	Capital		Labor		Human Capital		Labor	
		Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown
Hong Kong, China	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

continued.

Table 2a: *continued.*

Economy	Year	Capital		Labor		Human Capital		Labor	
		Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown
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
Singapore	2000	1.43	0.88	0.48	0.22	0.33	0.45	1.84	-0.75
	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
Trinidad and 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

GDP = gross domestic product.

Note: This table reports the 7-year average contribution of each input to the growth rate of 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. The remaining capital stock is then constructed by the perpetual inventory method.

Source: Authors' calculation.

Table 2b: Growth Accounting when the Labor Share is Set Equal to 0.65 (percent)

Economy	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
	1978	2.84	3.05	2.34	1.76	0.63	0.71	2.76	1.20
Hong Kong, China	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
	1994	1.82	0.84	-0.06	0.09	0.48	0.33	2.90	-0.46
Hungary	1979	1.82	0.70	-0.13	0.14	0.49	0.27	2.16	0.09

continued.

Table 2b: *continued.*

Economy	Year	Capital		Labor		Human Capital		TFP	
		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
	1970	2.23	2.64	1.91	1.50	0.39	0.63	2.88	0.14
Israel	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
	1974	1.96	1.21	0.22	0.41	0.32	0.42	2.62	0.59
	Italy								
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
	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
Korea, Republic of	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
	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
Kuwait	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
	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
Libya	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

continued.

Table 2b: *continued.*

Economy	Year	Capital		Labor		Human Capital		TFP	
		Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown
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
	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
	1999	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
	1994	3.33	2.68	0.96	0.74	0.66	0.65	2.27	0.58
Taipei,China	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
	1999	3.13	1.65	0.91	0.79	0.63	0.72	1.57	0.50
Trinidad and 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
United Kingdom	1980	12.51	2.69	9.02	3.75	0.30	0.57	7.64	-10.42
	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

continued.

Table 2b: *continued.*

Economy	Year	Capital		Labor		Human Capital		TFP	
		Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown	Before Slowdown	After Slowdown
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

Note: See note for Table 2a.

Source: Authors' calculation.

In Tables 3a and 3b we report summary statistics for these variables for the full sample countries; for countries experiencing growth slowdowns; and for the PRC, a country of special interest in this context. Tables 4a and 4b summarize the basic regressions.

Table 3a: Summary Statistics, Full Sample

	Observation	Mean	Std. Dev.	Min	Max
Per capita GDP	4,486	6,965	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)

GDP = gross domestic product.

Note: Values in parentheses are summary statistics for the sample used for growth accounting when we set labor share equal to 0.65 for every country.

Source: Authors' calculation.

Table 3b: Slowdown Countries and the People's Republic of China

	Obs.	Mean	Std. Dev.	Min	Max	PRC 2007	PRC Average*	PRC 2007	PRC Average*
						PWT Version 1	PWT Version 2		
Per capita GDP	142	16,740	5,980	10,004	40,614	8,511	5,402	7,868	5,505
Ratio	142	0.640	0.176	0.322	1.109	0.198	0.134	0.183	0.136
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	0.843	0.900	0.093	3.990	0.690	0.530	0.746	0.520
Financial openness	109	0.610	1.404	-1.831	2.500	-1.14	-1.14	-1.14	-1.14
Growth of terms of trade	125	-0.10	0.060	-0.224	0.176	-0.025	-0.033	-0.025	-0.033
Positive political change	124	0.145	0.354	0	1	0	0	0	0
Negative political change	124	0.073	0.260	0	1	0	0	0	0
Consumption share of GDP	142	0.535	0.092	0.327	0.851	0.375	0.440	0.365	0.443
Investment share of GDP	142	0.346	0.093	0.159	0.584	0.324	0.313	0.313	0.316
Government share of GDP	142	0.125	0.064	0.039	0.405	0.202	0.223	0.214	0.217
Aggregate GDP growth rate	142	0.064	0.033	-0.079	0.143	0.140	0.099	0.104	0.084
Capital contribution to GDP growth	121 (142)	0.026 (0.025)	0.009 (0.011)	0.010 (0.009)	0.053 (0.048)	(0.040)	(0.034)	(0.040)	(0.034)
Employment contribution to GDP growth	120 (141)	0.009 (0.009)	0.006 (0.006)	-0.002 (-0.004)	0.033 (0.027)	(0.007)	(0.009)	(0.007)	(0.009)
Human capital contribution to GDP growth	121 (132)	0.005 (0.005)	0.003 (0.003)	-0.001 (-0.001)	0.013 (0.012)	(0.005)	(0.006)	(0.005)	(0.006)
TFP contribution to GDP growth	120 (131)	0.025 (0.023)	0.028 (0.027)	-0.099 (-0.107)	0.086 (0.080)	(0.088)	(0.051)	(0.052)	(0.036)

GDP = gross domestic product, PRC = People's Republic of China, PWT = Penn World Table.

Note: Values in parentheses are summary statistics for the sample used for growth accounting when we set labor share equal to 0.65 for every country. There are two versions of PWT statistics, Version 1 and Version 2 for the PRC. The PRC average refers to the PRC's average value for the last 10 years.

Source: Authors' calculation.

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 per capita GDP reaches \$15,389 in constant 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 results there suggest that a growth slowdown typically occurs when per capita income reaches 58% 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, since their coefficients would imply that the slowdown began at different income levels. Still, it is

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

interesting to know which term—per capita income in levels or per capita income relative to the lead country—dominates when we run a horse race between them. The result of that horse race, 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 ratio than as a ratio to that in the lead country in the basic regressions that follow.

Table 4a: 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	339	339	332	332	332
Country	21					

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

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 parenthesis are robust standard errors.

Source: Authors' calculation.

Table 4b: 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)
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					

** and * denote 1% and 5% level of significance, respectively.

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 parenthesis are robust standard errors.

Source: Authors' calculation.

In addition, the manufacturing employment share and the manufacturing employment share squared are also significant. The peak probability occurs when manufacturing accounts for 23% 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 4a; the other effects for their part remain unchanged. Adding 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 \$18,569–\$18,973 range.

Tables 4b and 5–6 show that these patterns are robust to a variety of changes in sample and specification. Table 4a 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 5a and 5b 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 6a and 6b 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 4b), 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 (\$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).

Table 5a: Determinants of Growth Slowdowns for Entire Sample, Probit Model Using Chow Test Points

	Growth Slowdown			
	(1)	(2)	(3)	(4)
Per capita GDP	19.66** (4.46)		29.93** (7.65)	25.74** (6.24)
Per capital GDP^2	-0.98** (0.23)		-1.55** (0.43)	-1.31** (0.33)
Ratio		3.06** (0.50)	0.76 (1.26)	
Ratio^2		-0.90** (0.26)	0.10 (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

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The sample covers all the countries. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

Table 5b: Determinants of Growth Slowdowns for Entire Sample, Probit Model Using Consecutive Points

	Growth Slowdown			
	(1)	(2)	(3)	(4)
Per capita GDP	21.97** (5.20)		30.58** (8.69)	28.32** (7.05)
Per capital GDP^2	-1.10** (0.27)		-1.56** (0.48)	-1.44** (0.37)
Ratio		3.48** (0.55)	0.08 (1.57)	
Ratio^2		-1.04** (0.28)	0.20 (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

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The sample covers all the countries. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

V. Extensions

Our preferred results are those in Tables 6a and 6b, where the sample includes as many countries as possible other than oil exporters. We now use them 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 (as cases like Hong Kong, China and Singapore suggest), while terms of trade shocks might increase that likelihood.¹⁴ Old age and youth dependency rates might

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 PWT: exports plus imports divided by GDP in constant prices. The financial openness index is from Chinn and Ito (2008), who kindly supplied updates. For terms of trade shocks, we followed Hausmann, Pritchett, and Rodrik (2005),

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, 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 6b, column 6). Note that distinguishing the old age and youth dependency ratios, as here, also eliminates the anomaly of a positive coefficient on the fertility rate seen in some columns of Tables 4a and 4b.

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 6b, both the linear and squared terms in openness are statistically significant at the 1% 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 importantly 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%. 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.

defining a dummy variable denoted as 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% of the entire sample. This variable captures exceptionally adverse external circumstances.

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

Table 6a: Determinants of Growth Slowdowns for Non-oil Countries, Probit Models Using Chow Test Points

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

continued.

Table 6a: *continued.*

Growth Slowdown													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Financial openness										-0.10 (0.10)			
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** (6.72)	-31.33** (7.02)
Consumption share of per capita GDP^2												24.46** (5.41)	26.76** (5.71)
Investment share of per capita GDP												6.90 (7.20)	6.16 (8.63)
Investment share of per capita GDP^2												-14.02 (8.60)	-13.69 (11.43)
Government share of per capita GDP												8.68 (6.99)	6.10 (7.24)
Government share of per capita GDP^2												-25.45 (17.41)	-20.04 (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
Countrv	116	116	116	114	114	114	114	116	96	113	111	116	116

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The sample covers all except for oil countries. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

Table 6b: Determinants of Growth Slowdowns for Non-oil Countries, Probit Models Using Consecutive Points

	Deceleration												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Per capita GDP	56.86** (14.23)		58.07** (14.09)	78.48** (16.55)	83.68** (20.92)	79.11** (21.49)	83.40** (19.10)	78.32** (16.75)	82.93** (22.94)	84.53** (19.86)	64.30** (20.00)	88.86** (15.78)	93.75** (14.29)
Per capital GDP^2	-2.93** (0.75)		-2.30** (0.73)	-4.00** (0.87)	-4.27** (1.10)	-4.05** (1.12)	-4.25** (1.00)	-4.00** (0.88)	-4.24** (1.20)	-4.28** (1.04)	-3.33** (1.05)	-4.55** (0.83)	-4.81** (0.75)
Pre-slowdown growth				50.09** (5.50)	53.50** (6.15)	66.81** (9.47)	55.51** (6.29)	48.61** (6.21)	55.87** (7.15)	59.13** (7.45)		46.82** (8.95)	47.59** (8.51)
Ratio		13.67** (2.33)	-41.33 (21.86)										
Ratio^2		-10.17** (2.15)	14.11 (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 (0.71)	-2.72* (1.14)				-1.36 (0.91)

continued.

Table 6b: *continued.*

	Deceleration												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Trade openness in constant prices ^{^2}								0.25 (0.23)	1.41* (0.61)				0.55 (0.33)
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* (10.23)	-32.93** (11.16)
Consumption share of per capita GDP ^{^2}												21.47** (8.24)	27.05** (9.30)
Investment share of per capita GDP												9.50 (7.78)	18.63 (10.81)
Investment share of per capita GDP ^{^2}												-15.18 (10.19)	-31.97* (15.90)
Government share of per capita GDP												-1.06 (8.51)	-0.61 (9.18)
Government share of per capita GDP ^{^2}												-7.06 (19.56)	-10.01 (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

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The sample covers all except for oil countries. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

This brings us back to the cases of Hong Kong, China 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% in both economies, which suggests that other factors (economic policies and proximity to the PRC 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% of GDP (Table 6a or 6b, 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 6b, column 13).

VI. 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 seven years. The real exchange rate is defined as the nominal exchange rate (e) relative to purchasing power parity (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 overvaluation or undervaluation is then the difference between the actual real exchange rate and the fitted value.¹⁷

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.

Results are in Tables 7a and 7b. The most consistently significant policy variable is the degree of real undervaluation.¹⁸ Strikingly, this enters positively: countries 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, since 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. Or 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, with governments 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 buildup, as in the Republic of Korea in the 1990s, through that channel making a sustained deterioration in subsequent growth performance more likely.

Table 7a: Effects of Economic Policy, Chow Test Points

	Deceleration				
	(1)	(2)	(3)	(4)	(5)
Per capita GDP	55.38** (14.64)	57.60** (15.60)	62.29** (14.75)	60.00** (15.93)	65.34** (18.69)
Per capital GDP^2	-2.81** (0.77)	-2.92** (0.82)	-3.17** (0.77)	-3.02** (0.83)	-3.31** (0.98)
Pre-slowdown growth	35.92** (5.71)	36.94** (5.92)	36.29** (4.92)	36.81** (4.94)	41.02** (6.17)
Inflation	-0.00 (0.06)				-0.20 (0.30)
Inflation variability		0.01 (0.04)			0.13 (0.18)
Exchange rate variability			-0.01 (0.01)		-0.02 (0.01)
Undervaluation of real exchange rate				1.25* (0.60)	0.73 (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

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The sample covers all except for oil countries. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

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).

Table 7b: Determinants of Economic Policy using Consecutive Points

	Deceleration				
	(1)	(2)	(3)	(4)	(5)
Per capita GDP	75.27** (17.64)	75.38** (18.18)	77.82** (16.93)	78.60** (18.94)	74.31** (18.10)
Per capital GDP^2	-3.84** (0.93)	-3.84** (0.95)	-3.96** (0.89)	-3.97** (0.99)	-3.76** (0.95)
Pre-slowdown growth	56.67** (7.00)	56.01** (6.86)	49.91** (5.66)	56.01** (5.67)	57.48** (6.41)
Inflation	0.06 (0.05)				0.01 (0.39)
Inflation variability		0.04 (0.04)			0.05 (0.27)
Exchange rate variability			0.00** (0.00)		0.00** (0.00)
Undervaluation of real exchange rate				1.57** (0.60)	1.35* (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

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The sample covers all except for oil countries. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

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 since 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 \$20,000.¹⁹ For countries that never experience a growth slowdown, but with per capita GDPs below \$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 8a considers only the first slowdown for each country, while Table 8b 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 suggest that again, countries with undervalued real exchange rates are more vulnerable to slowdowns. In addition there is now some indication in this specification that policy instability, or high and variable inflation rates, are precursors to slowdowns. In

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

the consolidated specification in the last column of Table 8a, both the level and variability of inflation enter with significant negative coefficients, suggesting that in these countries slowdowns come at lower per capita incomes. The results in Table 8b reinforce the finding.

Table 8a: 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

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The duration is measured in per capita GDP. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

Table 8b: Hazard Model of 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

** and * denote 1% and 5% level of significance, respectively.

GDP = gross domestic product.

Note: The duration is measured in per capita GDP. Numbers in parenthesis are robust standard errors.

Source: Authors' calculation.

VII. Implications for the People's Republic of China

While an eventual growth slowdown is common to all fast-growing economies, special anxiety attaches to the question of how and when the PRC's growth might slow. The PRC in recent years has accounted for a substantial fraction of global growth. A sharp slowdown in the PRC's growth in the not too distant future could therefore have important implications for global expansion. In the PRC 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 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. For the PRC, being an outlier with its especially rapidly growing capital/labor ratio, a dummy variable is included in some variants of that equation, generating alternative forecasts for the country's future growth performance.

Inserting plausible projections for the exogenous drivers, the authors project the PRC as growing in the aggregate by 6.1%–7.0% per annum in 2011–2020, and 5.0%–6.2% in 2021–2030.²¹ This suggests that the PRC 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, slower increase in educational attainment, slower rate of increase in the capital stock and, most importantly, a slowdown in the country's heretofore rapid rate of TFP growth. 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 enrolment 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% per annum over the 2011–2030 period. Wilson and Stupnytska (2007), in a study adopting a simplified version of the same methodology, produced an estimate of 5.8% for 2008–2030. Maddison (2007) is more pessimistic, forecasting the PRC's annual average growth as slowing to 5.0% between 2004 and 2030.²³ Buiter and Rahbari (2011), relying heavily on the historical

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%, 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.

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

relationship between growth and convergence, projected growth of per capita income of 5.0% between 2010 and 2050 and, by implication, very slightly faster growth of overall GDP.

Basing his projections largely on the evolution of demographic trends and with optimistic assumptions about the returns to further investment in education, Fogel (2007) projects aggregate growth in the PRC as running at 8.4 over the longer period 2001–2040. While 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 downshift to 7.9% per annum growth in the course of the next 3 decades. If this downshift occurs abruptly, it would just barely constitute a slowdown according to our criteria, but spread over 3 decades it would not. Conference Board (2010) offers a base scenario in which growth proceeds by 9.2% per annum in 2010–2015 and 7.9% per annum in 2015–2020, by our metric avoiding a slowdown. But it also offers a pessimistic scenario in which the economy's growth slows first, from 6.1% per annum and then to 3.9% 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 the PRC'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 \$16,740 (2005 international PPP dollars); when the ratio of per capita income to that in the lead country is 58%; and when the share of employment in manufacturing reaches 23%. In Table 3b we see that the PRC's per capita GDP is \$8,511 and the ratio of per capita GDP to that in the US is 19.8% in 2007. If the PRC grows at 9.3%, which is the average growth rate of per capita GDP for the most recent 10 years in the PWT (1998–2007), by 2015, the PRC's per capita GDP reaches \$17,335, just exceeding our slowdown threshold. If the PRC grows more modestly at 7%, 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 US), forecasts for US growth also matter. If the US grows at 1.9% per annum, the average growth rate of per capita GDP in 1998–2007, then the ratio of the PRC's GDP per capita to that of the US will still be only 35% in 2015 even if the PRC grows at 9.3%. But if the current financial crisis substantially slows US growth rate to 1% through 2015, then the ratio increases to 37%. Either way, this remains well below the 58% ratio which, historically, has been the point where fast-growing catch-up economies slow down. If we assume 9.3% growth in the PRC and 1.9 (1.0) growth in the US, then the PRC reaches 58% of the US per capita income in 2023 (2021).

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

The PRC's share of manufacturing in total employment was 11.3% 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% per annum. If this is right, it suggests that the share of employment in manufacturing is now within hailing distance of the 23% where historical comparisons suggest that growth slows down.

Our results further suggest that the fact that the PRC's 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, heightening the likelihood of an imminent slowdown. Increasing the growth rate from 5% to 10% (the difference between the emerging market average and the PRC) raises the probability of a slowdown by 38% to 71% (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% (the estimate we obtain from the real exchange rate regression in this paper) raises the probability of a slowdown by 22% to 71%. That the consumption share of GDP is 48% rather than 64% (the latter, recall, being the ratio that minimizes the likelihood of slowing down) raises the probability of a slowdown by 16%–73%. The fact that the PRC's old-age dependency ratio is 10.1% rather than 9.4% raises the probability of a slowdown by 3.5%–77%. Finally, the fact that the PRC'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 slowdown in the PRC. Using the coefficients in Table 6b, columns 6 and 13—where the key independent variables are per capita income, pre-slowdown rate of growth, demographic structure (in column 6), trade openness, and composition of spending (in column 13)—puts the probability at 77% and 73%. Table 7b, column 5, where the independent variables are policy measures (inflation, inflation variability, and real undervaluation), puts the probability of a slowdown at 71%. These are certainly non-negligible odds.²⁶

One should of course exercise special caution when extrapolating to the PRC from the experience of other countries. Never before has such a large country grown so fast for such an extended period. The PRC's huge size and geographical diversity differentiate it from earlier fast growers such as Japan; the Republic of Korea; and Taipei, China. 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 the PRC, then the economic development of the interior provinces, which have larger

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

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.

populations than most countries and are home to a substantial fraction of the PRC'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 downside risks specific to the PRC to consider as well. These include the possibility of financial instability and social instability arising from large and growing inequality. To be sure, neither financial nor social instability is unique to the PRC. Nor is their association with growth slowdowns: the Republic of Korea, for example, experienced social instability in the late 1980s and financial instability in the late 1990s, the years bracketing that country's growth slowdown. Still, the broader point of the importance of taking into account the PRC'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 PRC economy? The empirical association between low levels of consumption and an undervalued exchange rate on one hand and a relatively high probability of a slowdown on the other reinforces a point made by foreign commentators and officials in the PRC 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 the PRC's growth is strong and other preconditions for its maintenance are still in place, than later, when those shifts are more likely to be sharply discontinuous and might 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

VIII. Conclusion

We have now grown accustomed to a world of exceptionally rapid catch-up growth in late-developing countries. The PRC and other emerging markets have come to account for 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

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, the PRC alone accounts for 30% of global demand growth; Brazil, the PRC, India, the Russian Federation (BRICs) collectively 45%; 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% of the global economy's 4.4% annual rate of economic growth over the coming decade.

Germany and the Republic of 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, are reasons to think that higher food prices are here to stay. That emerging markets like the PRC 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 for the PRC?”

As with all things economic, forecasting growth slowdowns is an imperfect science. International experience suggests that rapidly growing catch-up 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 \$17,000 in constant 2005 international (PPP) prices, a level that the PRC should achieve on 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%. While current data on employment shares in the PRC are not readily available, observation and extrapolation suggest that it is nearly there. Our estimates similarly suggest that growth slows when income per capita in a late-developing country reaches 57% of that in the country that defines the technological frontier, a level that the PRC is likely to reach only somewhat later.

Of course, there is no iron law of slowdowns. There is unlikely to be a mechanical relationship between per capita incomes and growth slowdowns. 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 the PRC will be able to continue driving global growth. But higher old age dependency ratios make growth slowdowns more likely, and the PRC 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 the PRC on this score.

Most provocatively, slowdowns are more likely to 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 to 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. While an undervalued exchange rate may be a driver of the PRC'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 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 government policy can operate to limit the risk of a sharp growth slowdown.

In some circles, the assumption is pervasive that the PRC will continue to grow rapidly. Equivalently, it is assumed that it 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, while a much larger group, in Latin America for example, are still struggling to escape the middle-income trap. Given the PRC's huge size and daunting array of structural challenges, completing this transition is far from a fait accompli.

Data Appendix

Growth Slowdown

1. Per capita GDP: Real GDP per capita (\$ in 2005 constant prices: chain series)
Source: Penn World Table 6.3
2. Growth accounting
 - (i) Aggregate GDP: Per capita GDP \times population
Source: Penn World Table 6.3
 - (ii) Labor force: Working age population between 15 to 64 years
Source: World Bank's *World Development Indicators 2010*
 - (iii) Capital
Source: Authors' calculations based on investment data
 - (iv) Labor share
Source: Bernanke and Gurkaynak (2001)
 - (v) Human capital: Educational attainment for population aged 25 and over
Source: Educational Attainment Dataset of Barro and Lee (2010)

Probit Regression

1. Demography
 - (i) Age dependency ratio, young: Percentage ratio of younger dependents (younger than 15 years) to the working-age population (15–64 years old)
Source: World Bank's *World Development Indicators 2010*
 - (ii) Age dependency ratio, old: Percentage ratio of older dependents (older than 64 years) to the working-age population
Source: World Bank's *World Development Indicators 2010*
 - (iii) Age dependency ratio: Percentage ratio of dependents (people younger than 15 or older than 64 years) to the working-age population
Source: World Bank's *World Development Indicators 2010*
 - (iv) Fertility Rate: Birth per woman
Source: World Bank's *World Development Indicators 2010*

Manufacturing Employment Share

Source: EUKLEMS.

External Sector

- (i) 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
Sources: World Bank's *World Development Indicators 2010*; data before 1980 were supplied by Hiro Ito
- (ii) Trade openness in constant prices: Total trade (exports and imports) as a percentage of GDP
Source: Penn World Table 6.3
- (iii) Financial openness: The index takes on higher values the more open the country is to cross-border capital transactions
Source: Chinn and Ito (2008) Index

Political Regimes

- (i) 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 (2010)
- (ii) 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

Policy Variables

- (i) Inflation: CPI change over corresponding period of previous year
Source : IFS line 64XZF
- (ii) Exchange Rate: US\$ = 1
Source: Penn World Table 6.3
- (iii) Real exchange rate: Exchange rate divided by PPP
Source: Penn World Table 6.3
- (iv) Debt-to-GDP ratio: Total government debt as a percentage of GDP
Source: Reinhart-Rogoff (2010) data set

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About the Paper

Barry Eichengreen, Donghyun Park, and Kwanho Shin analyze international historical evidence and find that economic growth slows down when per capita income reaches US\$17,000. Based on its current income and recent growth rates, the People's Republic of China could reach this income level as early as 2015. However, the authors point out that there are a number of special factors that may substantially prolong the People's Republic of China's era of rapid growth.

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