

The Role of Intangible Capital in the Transformation and Growth of the Chinese Economy

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Presentation to the IC8/WB Conference *Open Innovation, knowledge flow, and the New Innovation Policy agenda*, Paris France, May 21, 2012. These slides are for the sole purpose of the conference presentation and all rights, including publication rights, are retained by the authors. Any other use of the slides, including quotation, requires the written permission of the authors. Some of the results are in the process of revision.

Acknowledgements

Much of the work cited in these remarks was done under the auspices of The Conference Board Program on Intangible Capital. The data presented are derived from the research of a number of colleagues at TCB, including Carol Corrado, Kirsten Jaeger, Bart van Ark, and Harry Wu. Partial citations are summarized on the last slide. Opinions are solely those of the authors. The research is copyrighted to a number of sources, and should not be quoted or reproduced without the express permission of the authors or relevant copyright holders.

In The Paper:

- First estimates of China's intangible capital
- Comparison of Chinese intangible investment rates with other countries
- Estimates of the sources of Chinese labor productivity growth with intangible capital
- Discussion of data problems
- Comparison of sources of Chinese labor productivity growth with other countries

The Growth of the Chinese Economy

- The 1978 reforms
 - Shift toward “guided” private enterprises from state owned enterprises
 - Opening of economy to trade
 - High rate of capital formation
 - Technology capture
- Recent emphasis on science and technology
 - OECD (2007) report
 - Recognition of the need to move up the value chain
 - Examples of the iPod and iPhone
- The emerging role of intangible capital
 - Innovation is more than R&D
 - Investment in intangibles and move up value-chain

Issues of Sustainability and Convergence

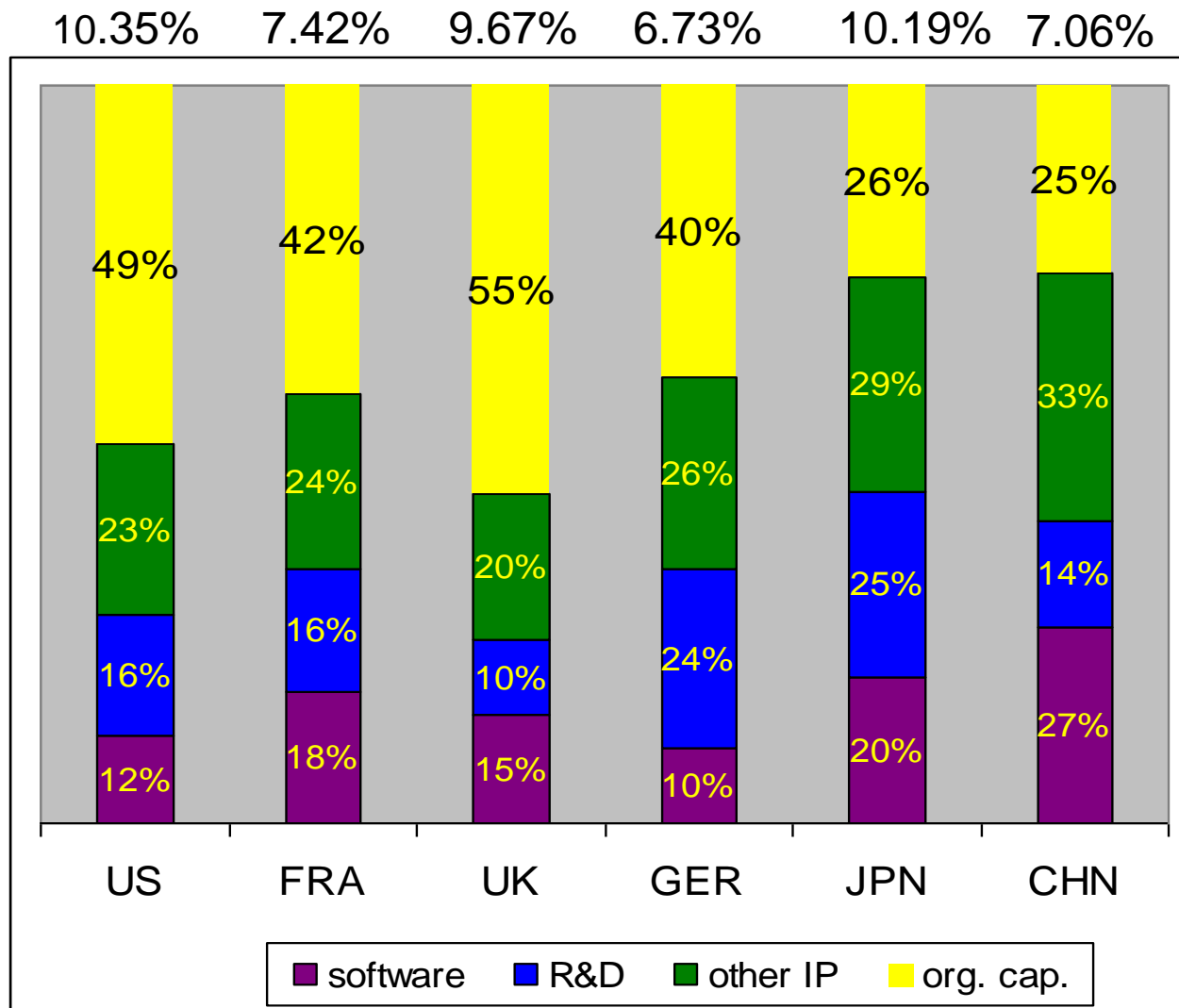
- China is appears to be in transition to a higher long-run growth path, with very high current growth rates
- But, it still a relatively poor country on average, with income per capita of \$6,770 in 2009
- Theory tells us that growth rates will slow as an economy in transition converges to higher growth path (middle income growth trap)
 - World Bank report *China 2030*
- Growing accounting yields inflated estimates of both TFP and capital deepening in early stages of transition
 - Krugman's inspiration effect biased by in-bound diffusion of technology
 - Krugman's perspiration effect biased by feedback effect of income on saving
- High saving rates characteristic of transitional economies

Table 1: Chinese Intangible Investment Rates (% GDP)

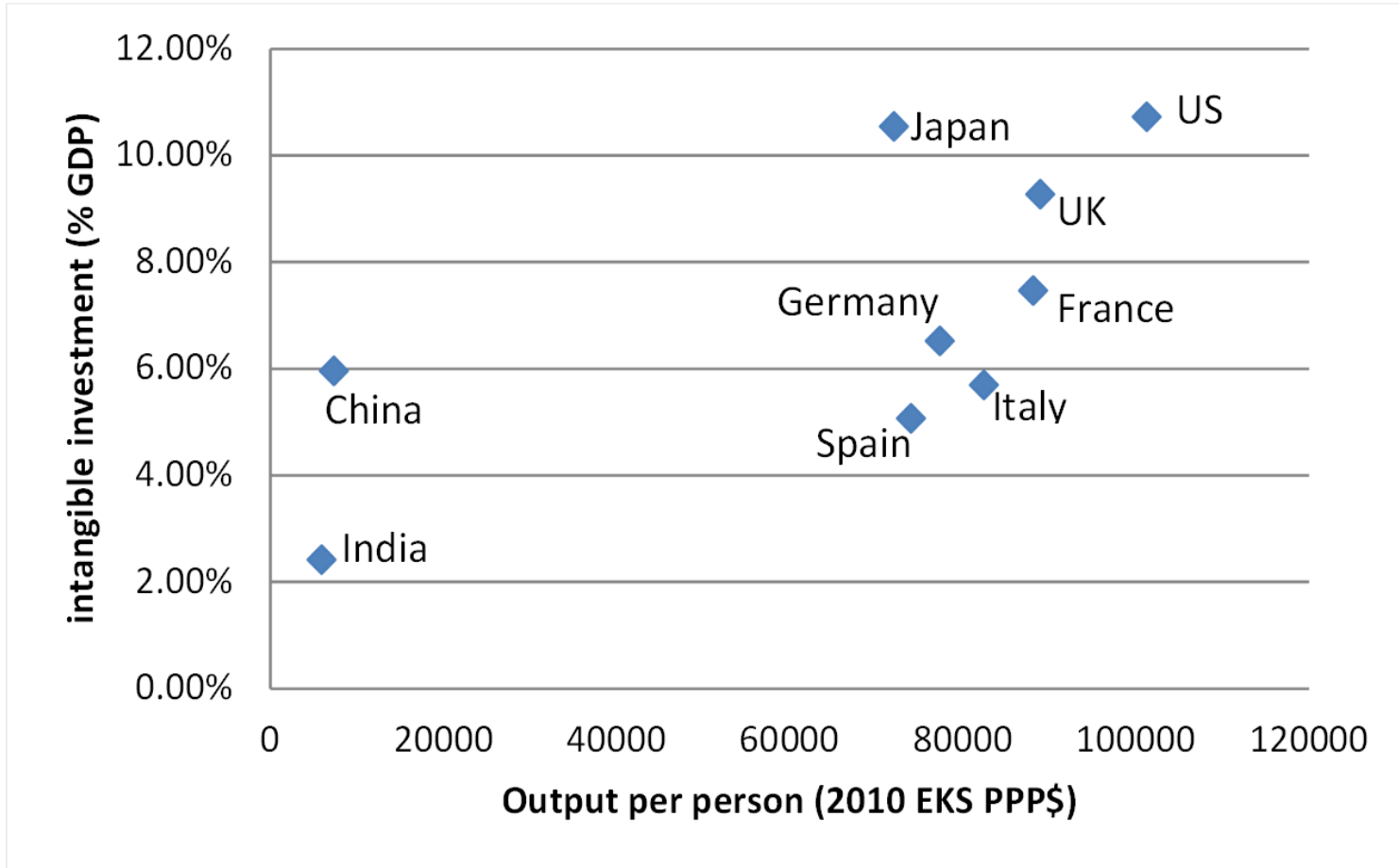
Type of Investment	all	all	market
	1990	2006	2006
1. Computerized information	0.01	1.87	1.88
2. Innovative property	2.48	3.79	3.38
a) R&D	0.68	1.34	1.02
b) Mineral exploration and evaluation	0.20	0.21	0.21
c) Copyright and license costs	0.27	0.12	0.08
d) Development costs in financial industry	0.64	0.46	0.47
e) New architectural and engineering designs	0.68	1.66	1.62
3. Economic competencies	1.29	1.81	1.80
a) Brand equity (advertising/marketing)	0.08	0.40	0.38
b) Firm-specific human capital	0.33	0.28	0.29
Continuing vocational training	0.33	0.28	0.29
c) Organizational structure	0.89	1.13	1.13
Total Investment	3.79	7.47	7.06

Sources: Chinese Statistical Yearbooks, various years. Annual reports of Chinese government Agencies.

Intl. Comparison of 2006 Intangible Inv. Rates

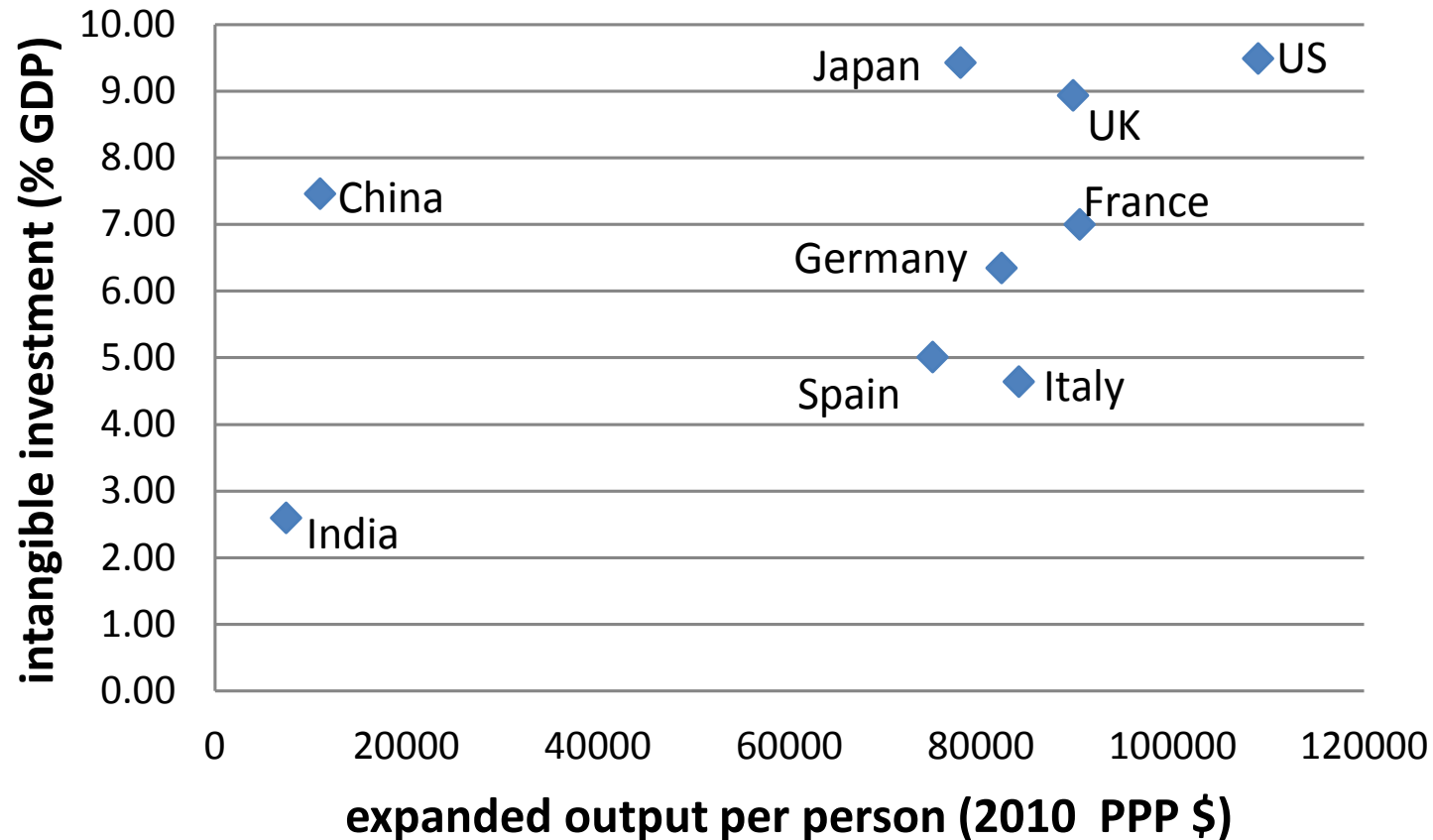


Comparison of intangible investment (% expanded GDP, 2001-2004)



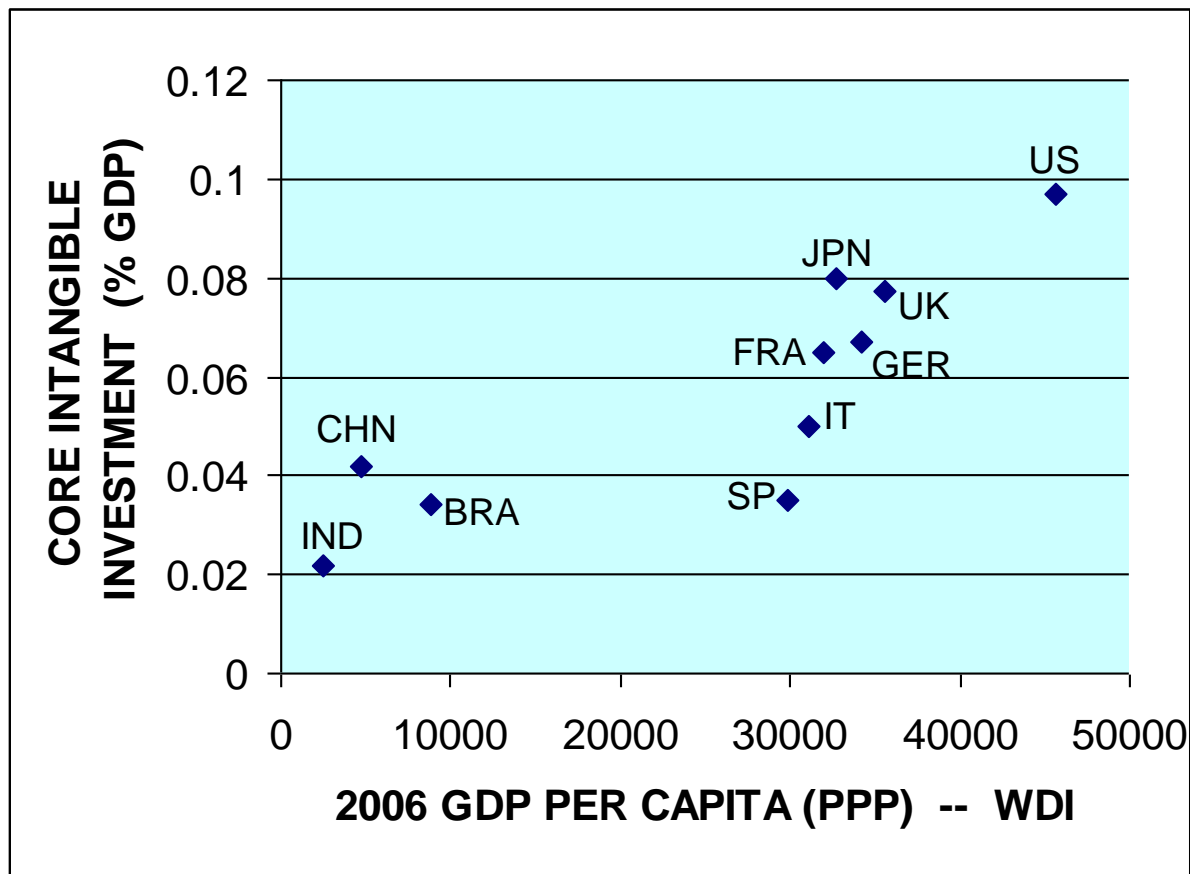
Source: Hulten, Hao, and Jaeger (2012). GDP *per capita* is from The Conference Board, Total Economy Database, version Sept. 2011. For intangible investment, sources are our estimates for China and India, Fukao *et al.* (2009) for Japan, and van Ark *et al.* (2009) for the rest of the countries.

Cross-National Comparison (% expanded GDP, 2006)



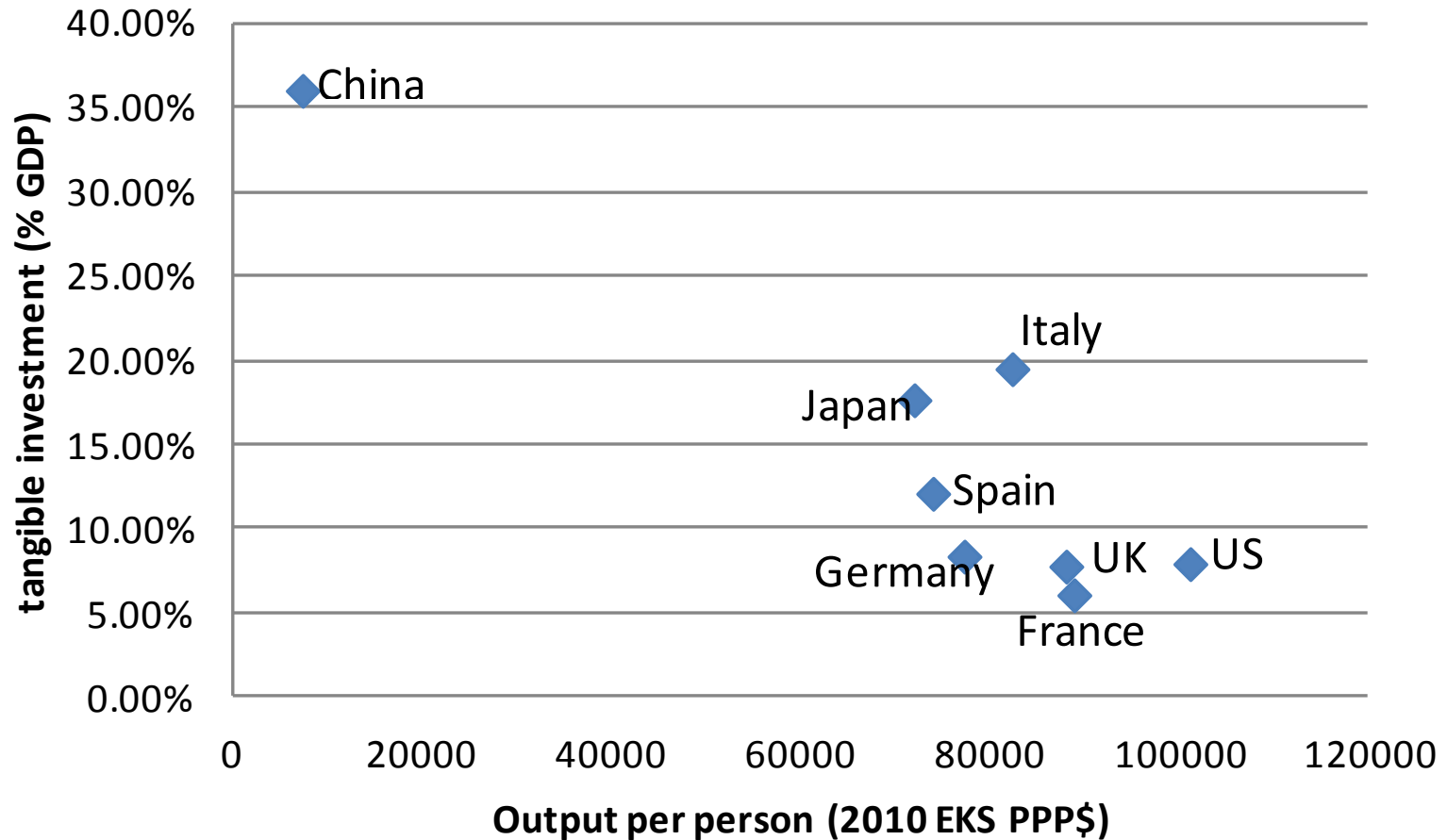
Source: GDP *per capita* is from the The Conference Board, Total Economy Database, version Jan. 2012. For intangible investment, sources are Fukao *et al.* (2009) for Japan, and van Ark *et al.* (2009) for the rest of the countries.

GDP per capita positively associated with “core” business investment in innovation

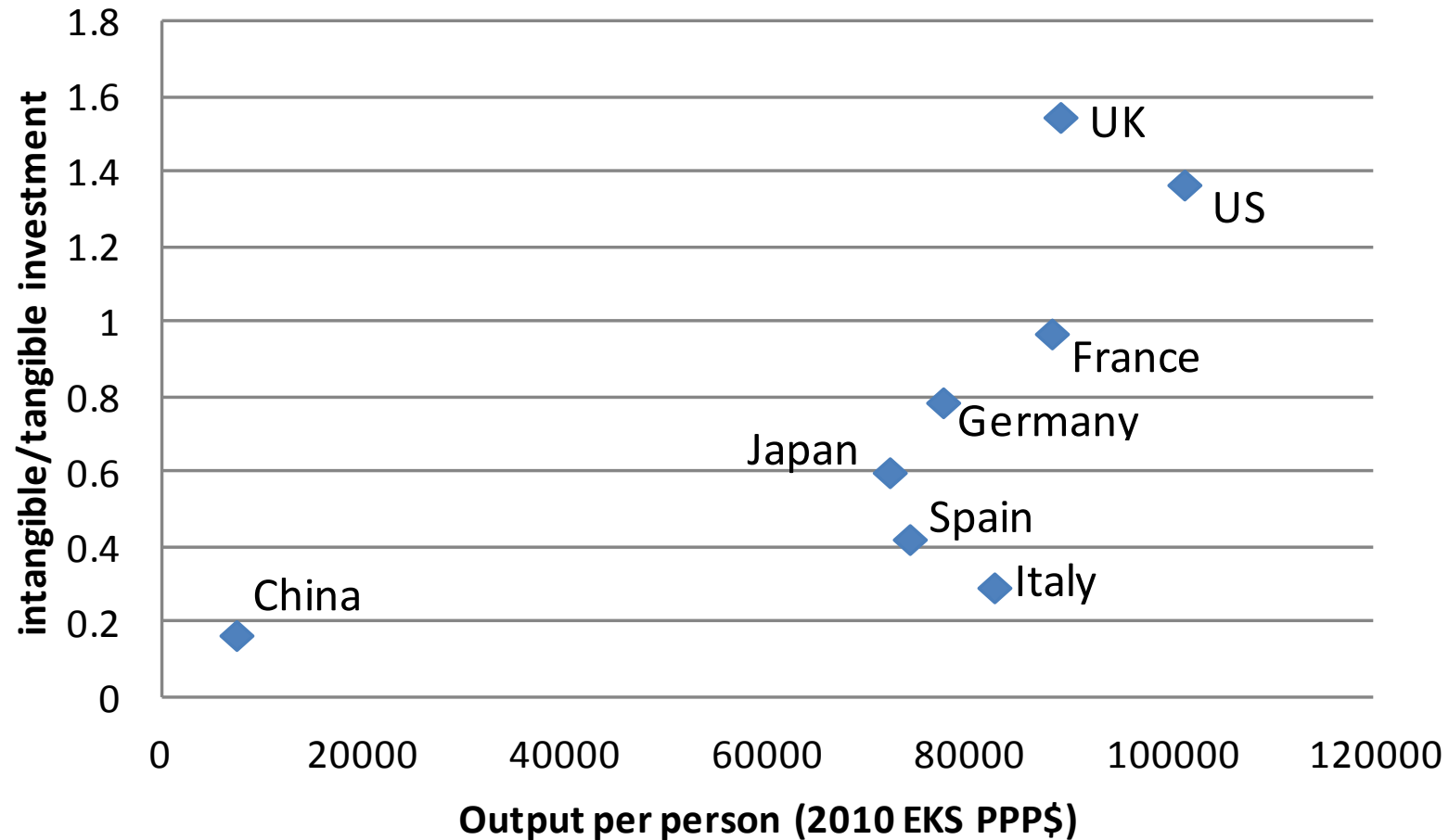


Sources: The sources for the seven countries on the right-hand side of the figure are described in Van Ark et. al. (2009). The estimate for China is from Hulten and Hao, 2012; the India estimate is from Hulten, Hao, and Jaeger (2012); and the Brazil estimate is from Mark Dutz of the World Bank. Results are preliminary and should not be quoted or reproduced without permission of the authors.

Tangible Investment and Output per Person (2001-04)



Intangible/tangible Investment and Output per Person (2001-04)



Growth Accounting versus Steady-State Convergence Theory

$$(5) \quad (Q/L)_t^* = e^{\lambda t} \left[\frac{A(X) (s_I^\alpha)(s_N^\beta)}{(n + \lambda + \delta)^{\alpha+\beta}} \right]^{(1/1-\alpha-\beta)} .$$

$$(6) \quad \frac{\dot{Q}_t}{Q_t} - \frac{\dot{L}_t}{L_t} = \mu [\ln(Q/L)^* - \ln(Q_t/L_t)] .$$

$$(3) \quad \frac{\dot{Q}_t}{Q_t} - \frac{\dot{L}_t}{L_t} = s_t^K \left(\frac{\dot{K}_t}{K_t} - \frac{\dot{L}_t}{L_t} \right) + TFPG_t .$$

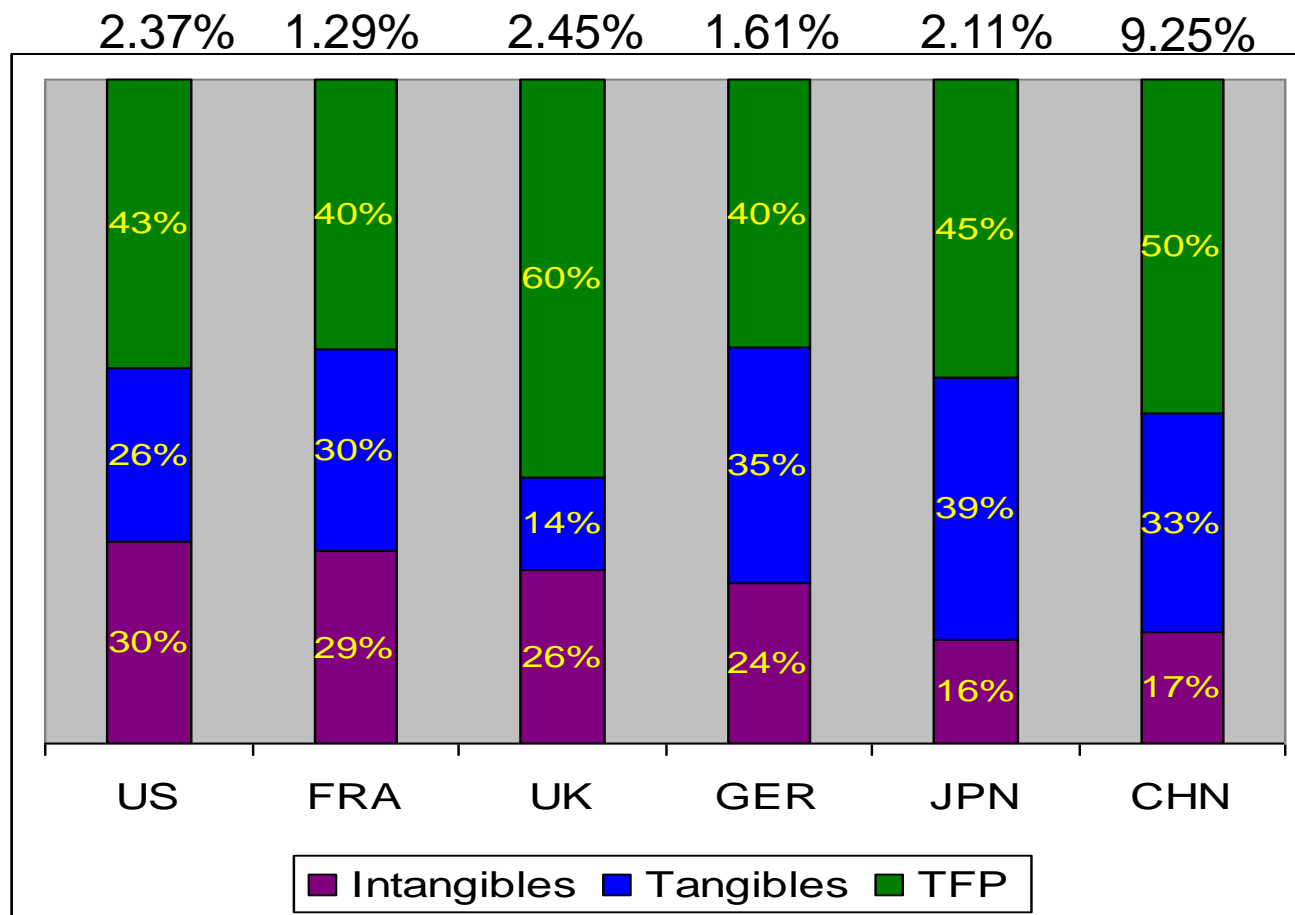
“Correct” TFP Depends on Size of Labor Share But Intangibles Important Either Way

AAGR (2000-08)	w/ intangibles		w/o intangibles	
Type of input shares	EIB	OWN	EIB	OWN
Capital Share	(38%)	(60%)	(30%)	(57%)
LP growth	9.72	9.72	9.65	9.65
Contributions				
Tangible capital	3.12	5.23	3.54	6.26
Intangible capital	1.58	1.47		
TFP	5.03	3.02	6.11	3.39

Note: OWN shares are calculated using official data provided by the National Bureau of Statistics of China, and EIB shares are the average of the shares of the U.S., the U.K., Germany, France, Italy, Spain, Austria and Denmark provided by van Ark et. al. (2009).

Relative Contributions to the Growth of Output per Person in Selected Countries 2000-2006*

(growth rates above bars)



Note: Japan coverage is 2000-2005. Alternative estimates for China assign 28% to TFP, 56% to tangible capital, and 16% to intangibles. See Hulten and Hao (2012) for sources and notes.

Comparison with Japan during its high growth era (%AAGR)

	China- EIB	China- OWN	Japan I	Japan II
Time period	2000-08	2000-08	1955-71	1955-71
LP growth	9.65	9.65	8.07	8.07
Contributions				
Tangible capital	3.54	6.26	5.19	4.41
TFP	6.11	3.39	2.88	3.66

Source for Japan: Nishimizu and Hulten, 1978

Conclusions

- **China's recent growth has been very strong**
 - **Don't really know how strong**
 - **Real estate boom**
- **Problems surrounding TFP estimates**
 - **Uncertainty about labor's share, and elasticity of output with respect to capital**
 - **Perspiration versus inspiration**
 - **TFP and diffusion of knowledge**
- **On the other hand, estimates do suggest**
 - **Intangible capital appears to be a reasonably important source of recent Chinese growth**
 - **Similarity between recent Chinese growth and Japan in its high-growth era**
 - **Large gap with U.S. despite recent high growth rates in China**

Partial Citations

- Corrado, Hulten, and Sichel, “*Measuring Capital and Technology: An Expanded Framework*,” in *Measuring Capital in the New Economy*, Studies in Income and Wealth, vol. 65, The University of Chicago Press for the National Bureau of Economic Research, Chicago, 2005
- Corrado, Hulten, and Sichel, “*Intangible Capital and U.S. Economic Growth*,” *Review of Income and Wealth*, 55, 3, September 2009
- Corrado and Hulten²⁰¹² “*How Do You Measure*