The Economy of People's Republic of China from 1953

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"In 1949 a new stage was reached in the endeavors of successive Chinese elites to meet domestic problems inherited from the Late Imperial era and to respond to the century-old challenge posed by the industrialized West. A central government had now gained full control of the Chinese mainland, thus achieving the national unity so long desired. Moreover, it was committed for the first time to the overall modernization of the nation's polity, economy, and society. The history of the succeeding decades is of the most massive experiment in social engineering the world has ever witnessed." (Fairbank and MacFarquhar 1987, p. xiii)

This paper

- Study Chinese economy from 1953-2012 through the lens of a two-sector neoclassical growth model
- Focus of analysis: 1953-1978
  - Pre-reform period is one of the largest development experiments in history
  - Key benchmark against which to measure the success of the reforms
- Analysis of factors behind growth and structural transformation
  - emphasis on the distortions that hinder reallocation and changes in these distortions

Main Results

- Construct a consistent dataset for 1953-2012 that allows application of the two-sector neoclassical growth model
- The policy cycle an essential feature of Chinese development:
  - Alternating left (Maoist) and right (pragmatist) policies are the principal driving force
  - Dramatic policy fluctuations at business cycle frequency
- Construct *direct quantitative proxies* for policies:
  - Consumption wedge: relative degree of rationing and shortages of agric/manuf goods
  - Production wedge: state procurement of agricultural goods
  - Capital wedge: prioritization of industrial sector and infrastructure construction
  - Investment wedge: consumer asset holdings vs general scarcity in consumer markets

Decomposition Methodology

- We propose a method to decompose changes in economic variables:
  - as sum of changes in TFPs and wedges and the proper elasticities.
- Tight connection with the tax incidence literature:
  - A change in wedge in period t has both contemporaneous and cross-effects
  - For most wedges sum of all cross-effects comparable to contemporaneous effect
  - For intertemporal wedge cross-effects dominate!
- Policies that we documented have clear effects on economic variables
  - Right policies
    - increase TFP pulling people out of agriculture (dominant)
    - increase distortions pushing people back towards agriculture
  - Left policies
    - lower TFP slowing movement out of agriculture
    - reduce distortions, ease transformation (dominant)

Related Literature

- Methodology

  - Cole-Ohanian (2004), Chari, Kehoe, McGrattan (2007), Cheremukhin et al (2017)
  - Golosov, Tsyvinski and Werquin (2014), Straub and Werning (2015)

- Chinese economic growth and structural transformation

  - no analysis with modern tools of pre-1978 (except for Gregory Chow but mainly data issues)
  - post-1978: Brandt and Rawski (2008), Brandt, Hsieh, Zhu (2008), Dekle and Vandenbroucke (2010, 2012), Young (2003), Brandt and Zhu (2010), Song, Storesletten, and Zilibotti (2011), Hsieh and Klenow (2010) focus on particular channels
  - we take a priori no stand on which channels are important, can quantify their relative importance

- Models of structural transformation:

  - Stokey (2001), Buera-Kaboski (2009, 2012), Caselli-Coleman (2001), Hayashi-Prescott (2008), Herrendorf-Rogerson-Valentinyi (2013)

Environment

- Consumers (CES):

$$U\left(c_A, c_M\right) = \sum_{t=0}^{\infty} \beta^t \left[\eta^{\frac{1}{\sigma}}\left(c_{A,t} - \gamma_A\right)^{\frac{\sigma-1}{\sigma}} + (1-\eta)^{\frac{1}{\sigma}}\left(c_{M,t}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

- Producers, Non-agriculture (M), CRS:

$$Y_t^M = F_M\left(K_t^M, N_t^M\right) = A_t^M \left(K_t^M\right)^{\alpha_M} \left(N_t^M\right)^{\beta_M},$$

- Producers, Agriculture (A), DRS:

$$Y_t^A = F_A\left(K_t^A, N_t^A\right) = A_t^A \left(K_t^A\right)^{\alpha_A} \left(N_t^A\right)^{\beta_A}.$$

Environment

- Goods market clearing:

$$N_t c_t^A + ex_t^A = Y_t^A,$$
$$N_t c_t^M + ex_t^M + G_t^M + I_t = Y_t^M.$$

- Labor and capital markets clearing:

$$N_t^A + N_t^M = \chi_t N_t,$$
$$I_t + (1 - \delta) K_t = K_{t+1},$$
$$K_t^A + K_t^M = K_t.$$

- Exports (exogenous at price x_t):

$$x_t ex_t^A + ex_t^M = 0.$$

Efficient Allocation

- Sectoral allocation of labor:

$$\frac{F_L^M(t)}{F_L^A(t)} \frac{U_{C_M}(t)}{U_{C_A}(t)} = 1,$$

- Sectoral allocation of capital:

$$\frac{F_K^M(t)}{F_K^A(t)} \frac{U_{C_M}(t)}{U_{C_A}(t)} = 1,$$

- Intertemporal allocation of capital:

$$\frac{U_{C_M}(t+1)}{U_{C_M}(t)} \beta \left(1 + F_K^M(t+1) - \delta\right) = 1.$$

- Undistorted competitive equilibrium decentralizes efficient allocation

- Represents a benchmark undistorted country (e.g. the U.S.)

Measurement of Distortions

- Standard macroeconomic data

  - $\{Y_{i,t}, C_{i,t}, N_{i,t}, K_{i,t}, ex_{i,t}, G_t\}_{i \in \{A,M\},t}$

- Benchmark undistorted economy

  - parameters for preferences and technology

- Given these data and parameters can measure distortions

Wedge Accounting

- Take $G_t, ex_{i,t}, N_t$ as given.
- Measure TFP and wedges

$$
\begin{aligned}
\frac{U_{C_M}(t)}{U_{C_A}(t)} \frac{F_L^M(t)}{F_L^A(t)} &= 1 + \tau_W(t), \\
\frac{U_{C_M}(t)}{U_{C_A}(t)} \frac{F_K^M(t)}{F_K^A(t)} &= 1 + \tau_R(t), \\
\frac{U_{C_M}(t+1)}{U_{C_M}(t)} \beta \left(1 + F_K^M(t+1) - \delta\right) &= 1 + \tau_K(t).
\end{aligned}
$$

- When price data are available, measure sub-components

Example of Further Decomposition

- Let p_i be prices, and w_i be wages

$$
\begin{aligned}
1 &= \frac{F_L^M(t)}{F_L^A(t)} \frac{U_{C_M}(t)}{U_{C_A}(t)} = \\
&= \frac{U_{C_M}(t)/p_{M,t}}{U_{C_A}(t)/p_{A,t}} \cdot \frac{p_{M,t} F_L^M(t)/w_{M,t}}{p_{A,t} F_L^A(t)/w_{A,t}} \cdot \frac{w_{M,t}}{w_{A,t}}
\end{aligned}
$$

- Each component equals one in efficient allocation

Components of inter-sector labor wedge

$$1 + \hat{\tau}_W(t) =$$

$$\underbrace{\frac{U_{C_M}(t)/p_{M,t}}{U_{C_A}(t)/p_{A,t}}}_{\textbf{consumption component}} \cdot \underbrace{\frac{p_{M,t}F_L^M(t)/w_{M,t}}{p_{A,t}F_L^A(t)/w_{A,t}}}_{\text{production component}} \cdot \underbrace{\frac{w_{M,t}}{w_{A,t}}}_{\text{mobility component}}$$

Distortions that may cause high wedge

- **Consumption component:** rationing; relative shortage; artificially low consumption of manufacturing versus agricultural goods

- Production component

- Mobility component

Components of inter-sector labor wedge

$$1 + \hat{\tau}_W(t) =$$

$$\underbrace{\frac{U_{C_M}(t)/p_{M,t}}{U_{C_A}(t)/p_{A,t}}}_{\text{consumption component}} \cdot \underbrace{\frac{p_{M,t}F_L^M(t)/w_{M,t}}{p_{A,t}F_L^A(t)/w_{A,t}}}_{\textbf{production component}} \cdot \underbrace{\frac{w_{M,t}}{w_{A,t}}}_{\text{mobility component}}$$

Distortions that may cause high wedge

- Consumption components

- **Production component**: relative mark-up; monopoly power; relative procurement

- Mobility component

Components of inter-sector labor wedge

$$1 + \hat{\tau}_W\left(t\right) =$$

$$\underbrace{\frac{U_{C_M}\left(t\right)/p_{M,t}}{U_{C_A}\left(t\right)/p_{A,t}}}_{\text{consumption component}} \cdot \underbrace{\frac{p_{M,t}F_L^M\left(t\right)/w_{M,t}}{p_{A,t}F_L^A\left(t\right)/w_{A,t}}}_{\text{production component}} \cdot \underbrace{\frac{w_{M,t}}{w_{A,t}}}_{\textbf{mobility component}}$$

Distortions that may cause high wedge

- Consumption component

- Production component

- **Mobility Component**: limitations to labor mobility to the city,
  barriers to acquire human capital

Discussion

- This is an accounting procedure:
  - competitive equilibrium with wedges as taxes reproduces data *exactly*

- Different policies and distortions manifest in different wedges and their subcomponents

- Need a decomposition methodology to:
  - measure the contribution of each wedge to each variable
  - study how *changes* in wedges contributed to *changes* in economic outcomes
  - at business/policy cycle frequency

Constructing consistent data (1953-2011)

- Hsueh and Li (1999): 1952-1978

    - sectoral value added and growth rates, price deflators and relative prices, nominal and construct real investment.

- China Statistical Yearbooks + 60 years: 1952-2012 aggregate and sectoral variables.

- Holz (2006) + CSY: 1978-2011 sectoral and aggregate capital.

- Use Holz (2006) and Chow (1993): 1953-1978

    - to construct sectoral capital; also provincial data.

- Holz (2006), CSY: Labor force and composition.

- Wages: Average Wages for Staff and Workers

- Prices: sectoral GDP deflators.

- Defense: HL, CSY, and SIPRI.

- Sectoral exports and imports: CSY, Fukao, Kiyota, and Yue (2006).

Policy Cycle

- Left policies: mobilization of productive resources at the expense of productive efficiency
- Right policies: easing pressure on peasantry and encouraging capitalist tendencies.
- R: First Five-Year Plan (1953-57)
- L: Great Leap Forward (1958-61)
- R: Recovery and Agriculture First (1962-66)
- L: Cultural Revolution (1967-72)
- R: Deng's influence (1973-75)
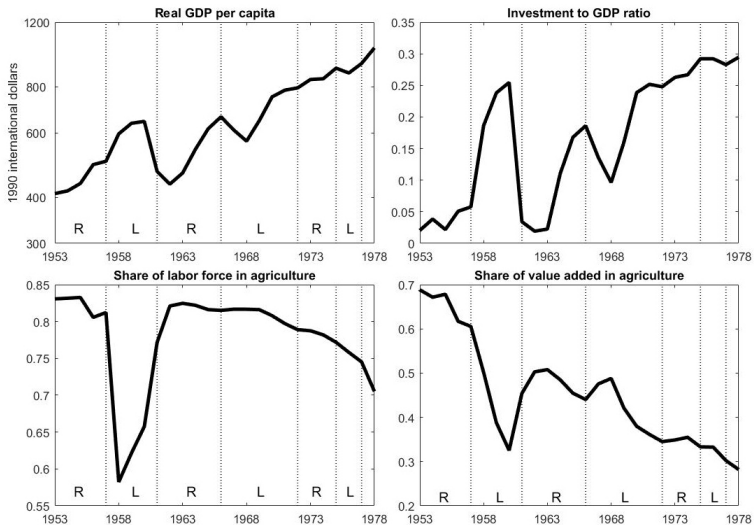- L: Gang of Four (1976-77)

Data 1953-1978

Figure: Macroeconomic indicators of People's Republic of China, 1953-78.

Data 1953-78

	Annual Growth Rate		
	1953-78	Right Pol.	Left Pol.
Real GDP	5.6	8.1	2.9
Agricultural value added	2.1	6.1	-2.3
Non-agricultural value added	9.0	10.5	7.3
Labor Force	2.5	2.6	2.4
Share of Labor Force in Agriculture	-0.5	-0.2	-0.8
Capital Stock	10.7	5.2	16.5

Table: Changes in economic indicators 1953-78.

Calibration

- Utility: $\beta = 0.96$; $\eta = 0.15$;
- Non-agricultural sector: $\alpha_{K,M} = 0.3$; $\alpha_{N,M} = 0.7$;
- Agricultural sector: $\alpha_{K,A} = 0.14$; $\alpha_{N,A} = 0.55$ (the rest is land);
    - Close to Hyashi and Prescott 2008; Tang (1982)
- Subsistence γ_A:
    - set to 54 yuan per capita in 1978 prices,
    - based on 1587 kcal average daily rural per capita energy intake, lowest value for the period
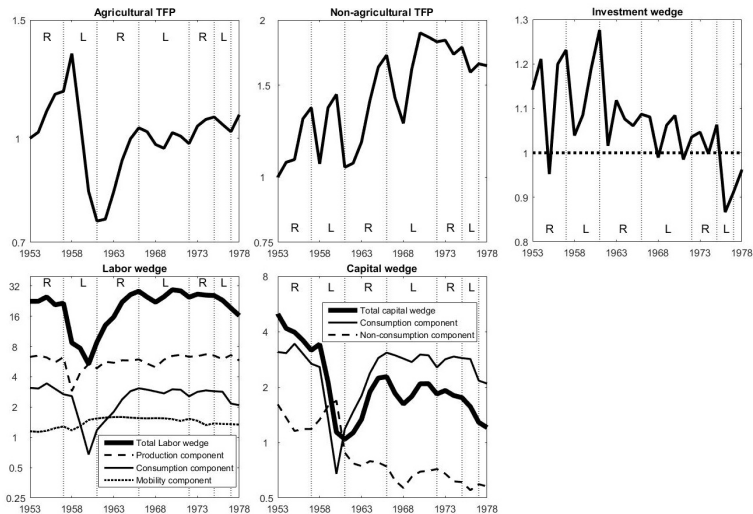- Baseline: $\sigma = 1$

Wedges and TFPs 1953-78

Figure: TFPs and Intersectoral Wedges

Wedges and TFPs

	53-57	58-61	62-66	R	L	53-78
Manuf. TFP, X^M	7.7	-6.6	9.9	5.9	-2.3	2.0
Agric. TFP, X^A	4.0	-11.1	6.4	4.8	-4.6	0.3
Total labor wedge	-1.0	-22.2	23.2	7.6	-10.9	-1.3
Cons. component, τ^C	-3.7	-20.4	19.1	6.8	-10.7	-1.6
Prod. component, τ^P	-0.1	-6.4	4.0	0.7	-1.5	-0.3
Mobil. component, τ^M	2.8	4.5	0.2	0.0	1.2	0.6
Total capital wedge	-11.4	-27.8	15.6	1.7	-13.6	-5.7
non-cons. component, τ^R	-7.7	-7.4	-3.4	-5.2	-3.0	-4.1
Investm. wedge, τ^K	1.9	0.9	-3.2	-0.0	-1.4	-0.7
GDP	7.4	-1.1	9.3	8.1	2.9	5.6
Labor share, p.p.	-0.5	-1.0	0.9	-0.2	-0.8	-0.5
Ideology	R	L	R			

Table: Annual growth rates of wedges, TFPs and economic variables by
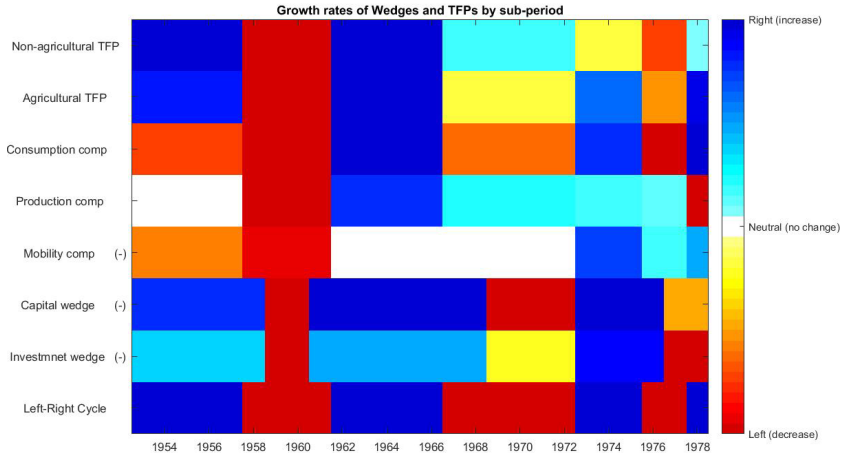subperiod, 1953-78

The Policy Cycle

Figure: Growth rates of TFPs and wedges by subperiod and ideology

The Policy Cycle

- Left (Maoist) policies:
    - mild growth of TFP
    - reduction of intersectoral labor distortion driven by consumption component
    - increased investment and capital wedge

- Right (pragmatic) policies
    - acceleration of TFP growth
    - mild increase in consumption and production components
    - reduced investment and capital wedges

Wedge Proxies and Policies

- Consumption component: shortages of agricultural goods
  - Market price/list price of agricultural goods (Sheng 1993b, Trade and Price Stat.)
  - Data on shortages of agricultural goods (Niu et al 1991)

- Production component: state procurement of agricultural goods
  - procurement of grain/rural grain supply (Ash 2006)
  - Price/wage distortion through implicit taxation of manuf sector (Imai 2000).

Wedge Proxies and Policies

- Non-consumption component of capital wedge: capital allocation prioritized industrial sector
  - State investment in agricultural infrastructure construction (Sheng 1993a)

- Intertemporal wedge: overall shortage/abundance of consumption goods
  - general scarcity indicator (Naughton 1986)
  - excess money holdings index (Naughton 1986)
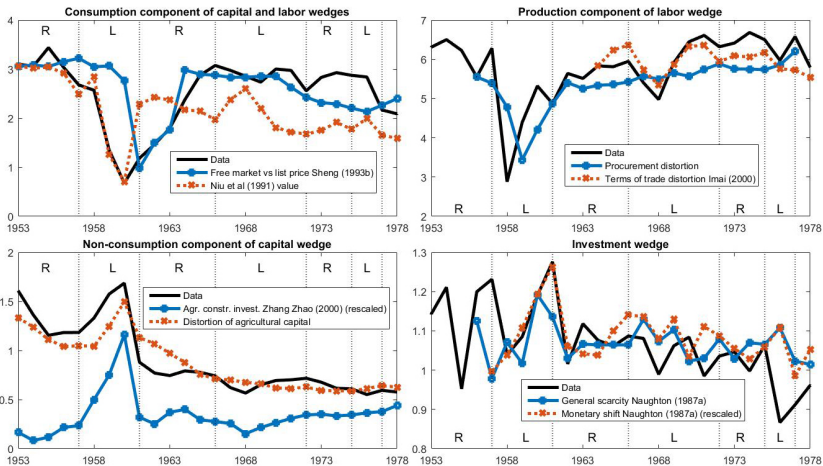
Wedge Proxies and Wedges

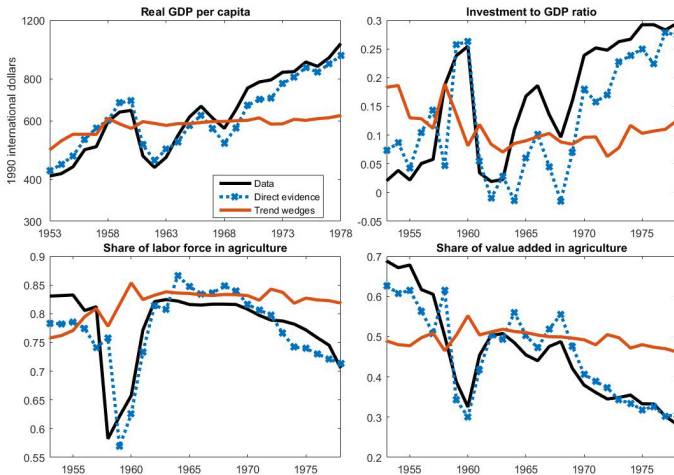Figure: Direct evidence for wedges

Model with Proxies for the Wedges

Figure: Counterfactual paths using direct evidence for wedges

Decomposition methodology

- This is a perfect foresight model - a dynamic system of deterministic equations:

$$F\left(x_t, y_t, x_{t+1}, \tau_t\right) = 0 \text{ for all } t,$$

where x_t are state and y_t control variables.

- Log-linearize and inverted to obtain:

$$z_s - z_s^* = \sum_{t=1}^{\infty} \epsilon_{\tau,t}^{z,s} \left(\tau_t - \tau_t^*\right) + \epsilon_{x,0}^{z,s} \left(x_0 - x_0^*\right),$$

where $z_s \in \{y_s, x_{s+1}\}$ and $\varepsilon_{\tau,t}^{z,s}, \varepsilon_{0,t}^{z,s}$ are elasticities.

- Application to two consecutive time periods leads to:

$$\ln \frac{z_{s+1}}{z_s} = \sum_w \sum_{t=1}^{\infty} \epsilon_{w,t}^{z,s} \ln \frac{\tau_{w,t+1}}{\tau_{w,t}} + \epsilon_{x,0}^{z,s} \ln \frac{x_1}{x_0},$$

- A change in economic variable z is the sum of changes in wedges τ in all periods, weighted by the elasticities.

Decomposition methodology

- Can accommodate terminal conditions in period T:

$$\ln \frac{z_{s+1}}{z_s} = \sum_w \sum_{t=1}^{T-1} \epsilon_{w,t}^{z,s} \ln \frac{\tau_{w,t+1}}{\tau_{w,t}} + \sum_w \sum_{t=T}^{\infty} \epsilon_{w,t}^{z,s} \ln \frac{\tau_{w,t+1}}{\tau_{w,t}} + \epsilon_{x,0}^{z,s} \ln \frac{x_1}{x_0},$$

- Add up changes over time to get integral elasticities:

$$\ln \frac{z_T}{z_1} = \sum_w \sum_{t=1}^{T-1} \left(\sum_{s=1}^{T-1} \epsilon_{w,t}^{z,s} \right) \ln \frac{\tau_{w,t+1}}{\tau_{w,t}} +$$

$$+ \sum_w \sum_{t=T}^{\infty} \left(\sum_{s=1}^{T-1} \epsilon_{w,t}^{z,s} \right) \ln \frac{\tau_{w,t+1}}{\tau_{w,t}} + \left(\sum_{s=1}^{T-1} \epsilon_{x,0}^{z,s} \right) \ln \frac{x_1}{x_0},$$

- Allows precise attribution of *changes* in economic outcomes to *changes* in wedges
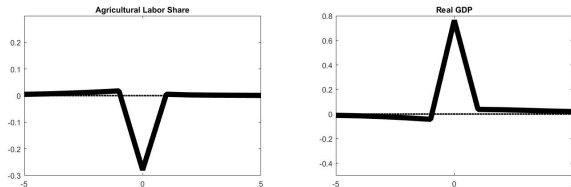
Elasticities

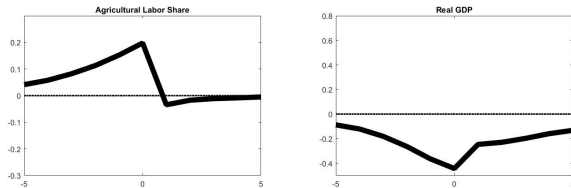Figure: Elasticity of Response to Agricultural TFP

Figure: Elasticity of Response to Investment Wedge
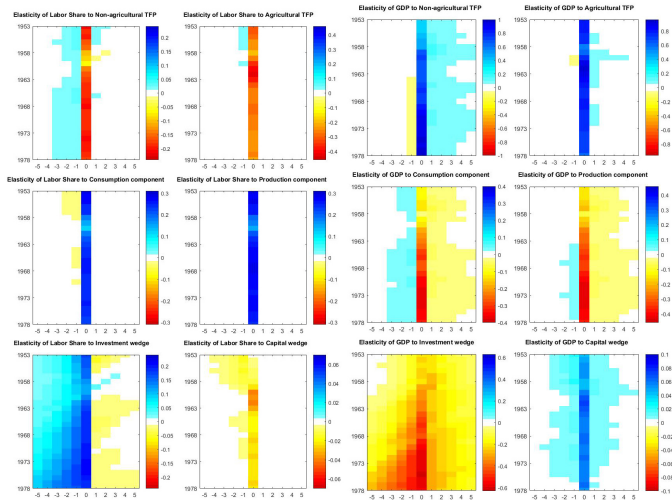
Elasticities to Wedges and TFPs

Figure: Elasticities to wedges and TFPs
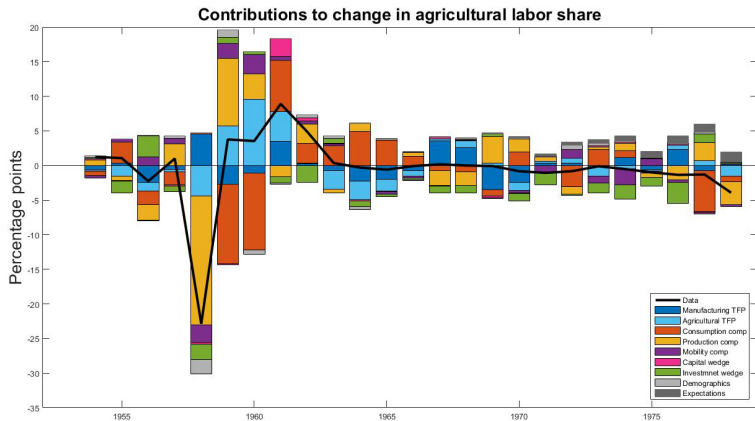
Decomposition of Changes in Labor Share

Figure: Decomposition of changes in labor share by year
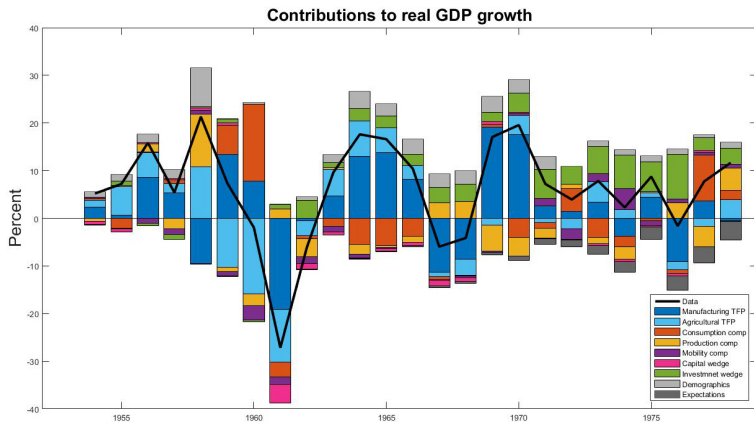
Decomposition of Changes in GDP

Figure: Decomposition of changes in GDP by year

Decomposition of Changes in Labor Share

	1953-57	1957-61	1961-66	1966-72	1972-75	1975-77	1953-78
Manuf. TFP, X^M	-3.3	3.4	-5.0	0.6	0.3	1.5	-2.6
Agric. TFP, X^A	-3.4	22.6	-7.2	1.5	-2.0	1.3	7.9
Cons. wedge, τ^C	-1.4	-21.5	16.0	-3.7	3.1	-6.1	-16.7
Prod. wedge, τ^P	1.0	-5.8	3.8	0.8	0.7	0.5	-2.7
Mobil. wedge, τ^M	2.1	4.7	0.1	0.0	-2.3	-0.4	3.6
Non-cons. comp. capital wedge, τ^R	-0.1	2.6	0.6	0.0	0.4	0.0	3.6
Investm wedge, τ^K	0.5	-1.4	-3.1	-4.6	-4.7	-1.8	-13.9
Defense	1.8	0.4	0.1	0.5	0.2	0.0	3.0
Labor force	-1.1	-1.2	-1.9	-2.6	-1.0	-0.6	-8.6
Population	1.9	-0.5	2.5	3.7	1.8	1.0	11.3
Agric. trade	0.3	-3.0	0.0	0.0	0.0	0.0	-2.7
Manuf. trade	-0.1	-0.4	0.1	0.0	0.1	0.0	-0.3
Expectations	0.0	0.1	0.2	1.6	2.1	2.2	7.9
Initial capital, K_{1953}	3.2	-0.1	0.1	0.1	0.0	0.0	3.1
Total	1.0	-6.9	4.6	-2.7	-1.7	-2.9	-12.5
Data change	-1.8	-4.1	4.4	-2.6	-1.7	-2.7	-11.9

Table: Wedge decomposition of changes in labor share, (percentage points), 1953-78

Decomposition of Changes in GDP

	1953-57	1957-61	1961-66	1966-72	1972-75	1975-77	1953-78
Manuf. TFP, X^M	16.4	-11.0	36.9	16.7	3.8	-6.0	56.4
Agric. TFP, X^A	14.2	-29.6	17.4	-5.3	6.9	-3.4	4.2
Cons. wedge, τ^C	-0.8	17.5	-17.7	-0.9	-7.0	8.4	1.4
Prod. wedge, τ^P	-0.9	9.0	-7.2	-4.1	-3.4	-1.1	-3.0
Mobil. wedge, τ^M	-2.0	-4.9	-3.7	-1.0	5.0	1.3	-4.8
Non-cons. comp. capital wedge, τ^R	-0.9	-2.8	-3.1	-1.1	-1.3	-0.3	-9.7
Investm wedge, τ^K	-0.9	1.5	12.1	22.5	18.3	11.7	68.6
Defense	-2.6	0.7	0.1	-1.6	-0.6	0.0	-4.0
Labor force	7.5	9.0	14.4	23.5	9.8	5.6	73.1
Population	-1.2	-0.4	-2.7	-6.3	-3.8	-25.6
Agric. trade	-0.4	1.9	-0.9	-0.4	-0.1	0.0	0.0
Manuf. trade	0.1	0.8	-0.9	-0.3	-0.4	-0.1	-0.8
Expectations	0.0	-0.1	-0.8	-5.0	-6.6	-6.5	-23.0
Initial capital, K_{1953}	3.4	1.2	0.5	0.2	0.0	0.0	5.4
Total	32.0	-7.2	44.4	34.1	18.2	5.8	138.3
Data change	29.7	-4.5	46.6	33.8	18.2	5.7	140.5

Table: Wedge decomposition of changes in GDP, (log points), 1953-78

Conclusion

- Dataset for 1953-2012 to compute TFPs and distortions

- First systematic analysis of pre-reform economy with modern tools

- Policy cycle the principal driving force of Chinese development

- Direct quantitative evidence for Mao's policies

- Novel decomposition methodology to study effects of policies

- Policy cycle persisted into the reform period, aligning with the party congresses
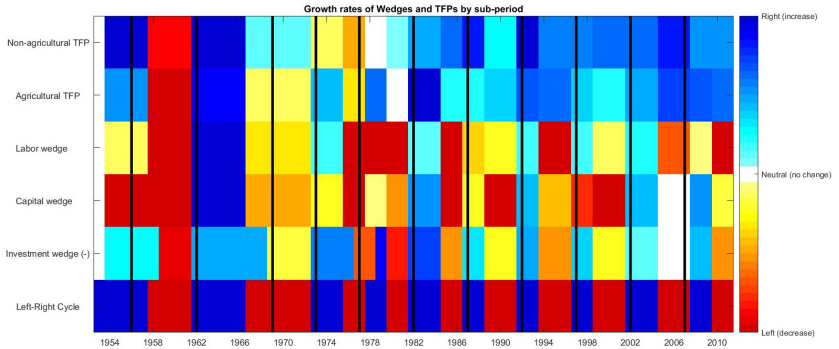
The Policy Cycle post-1978

Figure: Growth rates of TFPs and wedges by subperiod and ideology