Formula Sheet

1. National Income Accounting Identity

\[ Y = C + I + G + NX \]

2. GDP deflator

\[ \text{GDP deflator} = \frac{\text{nominal GDP}}{\text{real GDP}} \]

3. Implicit measure of inflation

\[ \text{Inflation rate} \ 2004 = \left( \frac{\text{GDP deflator} \ 2004 - \text{GDP deflator} \ 2003}{\text{GDP deflator} \ 2003} \right) \times 100\% \]

4. Consumer Price Index (CPI)

\[ \text{CPI in any month} = \frac{\text{Cost of basket in that month}}{\text{Cost of the same basket in base period}} \times 100 \]

5. Inflation rate (using CPI)

\[ \text{Inflation rate} \ 2004 = \left( \frac{\text{CPI} \ 2004 - \text{CPI} \ 2003}{\text{CPI} \ 2003} \right) \times 100\% \]

6. Labor force

\[ \text{Labor force} (L) = \text{employed persons} (E) + \text{unemployed persons} (U) \]

7. Unemployment

\[ \text{Unemployment rate} \ (U/L) = \frac{\# \text{ of unemployed} \ (U)}{\text{labor force} \ (L)} \times 100\% \]

8. Labor force participation

\[ \text{Labor force participation rate} \ (L/POP) = \frac{\text{labor force} \ (L)}{\text{adult population} \ (POP)} \times 100\% \]
9. Steady-state labor market

\[ s \times E = f \times U \]

where \( s \) is the rate of job separation and \( f \) is the rate of job finding.

10. Natural rate of unemployment

If you manipulate the condition for the steady-state in the labor market (9), you would get

\[ \frac{U}{L} = \frac{s}{s + f} \]

11. Marginal productivity of capital and labor and real prices of capital and labor for the Cobb-Douglas production function \( Y = F(K, L) = AK^\alpha L^{1-\alpha} \):

\[ MPK = \frac{\alpha Y}{K} \]
\[ MPL = (1-\alpha)\frac{Y}{L} \]

12. Real prices of capital and labor

\[ MPK = r \]
\[ MPL = w \]

13. National income and total capital and total labor incomes

\[
\begin{align*}
\text{total capital income} &= r \times \bar{K} = MPK \times \bar{K} \\
\text{total labor income} &= w \times \bar{L} = MPL \times \bar{L}
\end{align*}
\]

\[ \text{national income} \bar{Y} = \text{total capital income} + \text{total labor income} \]
\[ \bar{Y} = MPK \times \bar{K} + MPL \times \bar{L} \]

14. Consumption function

\[ C = a + bY^d \]

where \( a \) is the intercept, \( b \) is the marginal propensity to consume (MPC) and \( Y^d \) is disposable income \( (Y - T) \).
15. Saving

\[
\text{Private saving} = (Y - T) - C \\
\text{Public saving} = T - G \\
\text{National saving} = Y - C - G
\]

16. Per worker national identity

\[
y = c + i
\]

where \( y = Y/L \), \( c = C/L \), and \( i = I/L \).

17. Per worker consumption function

\[
c = (1 - s)y
\]

where \( s \) is the saving rage (fraction of income that is saved).

18. The equation for motion of capital

\[
\Delta k = sf(k) - (\delta + n + g)k
\]

where \( \delta \) is the rate of depreciation, \( n \) is the population growth, and \( g \) is the rate of technological progress.

19. Steady-state condition in the Solow model

\[
sf(k) - (\delta + n + g)k
\]

20. Income, consumption and investment per person

\[
y = f(k) \\
c = (1 - s)f(k) \\
\text{saving} = i = sf(k)
\]

21. The Golden rule capital stock

\[
MPK = \delta + n + g
\]

22. Sources of economic growth

\[
\frac{\Delta Y}{Y} = \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L} + \frac{\Delta A}{A}
\]
23. The quantity equation
\[ M \times V = P \times Y \]
and the quantity equation in percent change
\[ \%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Y \]
where \( \%\Delta M \) is the growth of money supply, \( \%\Delta P \) is the rise in prices (inflation), and \( \%\Delta Y \) is the change in real output.

24. Fisher equation
\[ i = r + \pi \]
where \( i \) is the nominal interest rate, \( r \) is the real interest rate, and \( \pi \) is the rate of inflation.

25. Money demand function
\[ \left(\frac{M}{P}\right)^d = L(r + \pi^e, Y) \]
where \( M/P \) is the real money demand, \( i \) is the nominal interest rate, \( \pi^e \) is the expected inflation, and \( Y \) is income.

26. Seignorage
\[ \text{seignorage} = \frac{\Delta M}{M} L(r + \pi^e, Y) \]
where \( \Delta M/M \) is the growth rate of money supply and \( L(r + \pi^e, Y) \) is money demand.

27. Net capital outflows
\[ NX = S - I \]

28. Real exchange rate
\[ \varepsilon = \frac{e \times P}{P^*} \]
where \( \varepsilon \) is the real exchange rate, \( e \) is the nominal exchange rate, \( P \) is domestic price (price of a good in US dollars), and \( P^* \) is the foreign price (price of a good in foreign currency).

29. Government purchases multiplier
\[ \frac{\Delta Y}{\Delta G} = \frac{1}{1 - MPC} \]
where \( MPC \) is marginal propensity to consume
30. Tax multiplier
\[
\frac{\Delta Y}{\Delta T} = \frac{-MPC}{1 - MPC}
\]
where $MPC$ is marginal propensity to consume.

31. IS curve
\[
Y = C(Y - T) + I(r) + G
\]
Def: a graph of all combinations of $r$ and $Y$ that result in goods market equilibrium.

32. LM curve
\[
\frac{M}{P} = L(r, Y)
\]
Def: a graph of all combinations of $r$ and $Y$ that equate the supply and demand for real money balances.

33. $IS^*$ curve
\[
Y = C(Y - T) + I(r^*) + G + NX(e)
\]
Def: a graph of all combinations of $e$ and $Y$ that result in goods market equilibrium.

34. $LM^*$ curve
\[
\frac{M}{P} = L(r^*, Y)
\]
The $LM^*$ curve is vertical since it does not depend on the exchange rate.

35. Money supply
\[
M = C + D
\]
where $M$ is money supply, $C$ is currency, and $D$ is demand deposits.

36. Monetary base
\[
B = C + R
\]
where $B$ is the monetary base, $C$ is currency, and $R$ is banks' reserves.

37. Reserve-deposit ratio
\[
rr = R/D
\]
where $rr$ is reserve-deposit ratio, $R$ is banks' reserves, and $D$ is demand deposits.

38. Currency-deposit ratio
\[
cr = C/D
\]
where $cr$ is currency-deposit ratio, $C$ is currency, and $D$ is demand deposits.
39. Money multiplier

\[ m = \frac{cr + 1}{cr + rr} \]

where \( m \) is the money multiplier, \( cr \) is currency-deposit ratio, and \( rr \) is reserve-deposit ratio.

40. Money supply 2

\[ M = m \times B \]

where \( M \) is money supply, \( m \) is the money multiplier, and \( B \) is the monetary base.

41. Money demand according to portfolio theory

\[ (M/P)^d = L(r_s, r_b, \pi^e, W) \]

where \( r_s \) is the expected real return on stocks, \( r_b \) is the expected real return on bonds, \( \pi^e \) is expected inflation, and \( W \) is real wealth.

42. Money demand according to transaction theory (Baumol-Tobin)

\[
\begin{align*}
\text{average money holdings} & = \frac{Y}{2N} \\
N^* & = \sqrt{\frac{iY}{2F}} \\
(M/P)^d & = L(i, Y, F) = \sqrt{\frac{YF}{2i}}
\end{align*}
\]

where \( Y \) is total spending over a year, \( i \) is the interest rate on savings account, \( N \) is the number of trips consumer makes to the bank to withdraw money from the savings account, and \( F \) is the cost of a trip to the bank.