CAPITAL INFLOWS AND SILVER STANDARD IN INDIA

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Abstract: In this paper author tries to relate gold and silver inflows with GDP,GDP per capita,export, import and gold silver price ratio in India during silver standard regime from 1851 to 1893. Author used semi-log,double-log regression models, Johansen cointegration and VAR models (1991,1996) and Bai-Perron model(2003) for structural change taking data from Maddison(2006) and Ambedkar(1923). The paper concludes that gold inflows during 1851-1893 had decreased at the rate of 0.34% per year insignificantly but it was nonstationary, convergent and had no structural breaks. Silver inflows during 1851-1893 had increased at the rate of 1.51% per year insignificantly and found nonstationary and convergent and had one upward structural break in 1857.No cointegration among gold or silver inflows with GDP,GDP per capita, export, import and gold silver price ratio was found during 1851-1893 where VAR model was unstable and nonstationary and impulse response functions were diverging. Semi-log linear regression model among silver inflows and gold inflows with those variables were also insignificant although GDP, export, import,and gold silver price ratio had been increasing at the rates of 0.52%,9.14% ,5.16% and 0.77% per year significantly. But double-log linear regression model suggested that gold inflows had significant impact from GDP,GDP per capita, export, and gold-silver price ratio but had no significant impact of silver inflows from those variables during 1851-1893 respectively. Yet,there is bidirectional causality among gold inflows, GDP, GDP per capita, export, import and gold silver price ratio significantly during the given period. Even, there were sharp depreciation of rupee sterling rate,falling silver price ,silver production and rising gold price and gold production during the silver standard regime. Thus, gold and silver inflows could not synthesize the silver standard more effective in macro-dynamic adjustment during 1851-1893 although the series of managerial experiments of the commissions and government are equally responsible for instability of the silver standard in India which was equally identical with gold standard in England

Key words: Net gold inflows, net silver inflows, silver standard, GDP, export, import, cointegration, VAR

Introduction: Silver standard in India was introduced in 1835 but the act of XVII and the act of XXI in 1835 declared both silver coin and copper coins as legal tender ,on the other hand , gold coin was not legal tender yet it was circulated. Later on, in 1861 by Act of XIX , gold coin was treated as legal tender. In 1861,the paper currency notes were circulated. The gold:silver was 1:15.5 and rupee sterling rate was fixed at 1s10.5d where exchange was governed by relative values of gold and silver.

During long 400 years from 1493 to 1893 , gold and silver production were more or less uniform but during 1600-1700,index of gold rose from 130 to 176,which rose to 270 during 1700-1800.In 1870,the index of gold production stipulated to 2124 as compared to 450 for silver. Even the rupee sterling rate depreciated and price of gold silver ratio appreciated to a lager extend. India was one of chief producer of the silver and gold but she was the net importer of both gold and silver which were volatile. Although silver standard during 1873-1893 in India was as like as gold standard in England during 1873-1893,yet British government introduced several policies of mints, currency circulation as well as bimetallism as an experimental basis which made the silver standard unstable .During this period, most of the countries in the world started to introduce gold standard including British colonies. In India, gold supplies and its prices were stipulating compared to silver, but British Government denied to introduce gold standard in spite of numerous positive signals of implementing gold standard by many commissions. In 1893, England declared gold exchange standard in India where gold was not convertible to rupee but rupee was convertible to sterling which was fixed parity with gold. Therefore , success story of silver standard is little yet there is no vital disturbance in working the system of silver standard in India.

Objective of the paper: In this paper author endeavours to analysis the working of capital inflows in the silver standard in India and its impact on the GDP ,GDP per capita and on international trade and even on the gold silver price ratio during 1851-1893.The net gold import and net silver import were considered as capital flows for the specified period.

Methodology and data: Net gold import and net silver import were treated as capital flows in India during 1851-1893.The trend lines of gold inflows, silver inflows, export, import, GDP,GDP per capital, ratio of gold and silver price were calculated by semi-log linear model. Stationary was observed through ARIMA model, structural change was shown by Bai-Perron model(2003).Double-log multiple regression model was used for showing relationship among those variables with gold and silver inflows for the specified period. Since there is no cointegration with

gold inflows and other variables and silver inflows with other variables ,author used Johansen VAR model(1991,1996) for showing relationship analysing residual tests and impulse response functions. Even,Granger (1969) model was tested for causality.Data for GDP and per capita GDP were collected from Maddison(2006) and data for all other variables were taken from B.R.Ambedkar(1923). Assume,x_1=GDP,x_2=GDP per capita,X_3=export,x_4=import,x_5=gold silver price ratio,y_1=net gold import,y_2=net silver import

Some observations of the model: During the silver standard regime in India from 1851 to 1893,net gold inflows had been decreasing at the 0.34 per cent per year which was insignificant.

$Log(y_1)=14.770-0.003433t$ (58.54)* (-0.34)

R^2=0.0028,F=0.118 ,DW=0.46 , y_1= net gold inflows(imports) ,*=significant at 5% level.

Net gold inflow from 1851 to 1893 is convergent but nonstationary because its AR(1) is convergent and stationary but its MA(1) is convergent and nonstationary.

$Log(y_{1t})=14.63648+0.7232log(y_{1t-1})+\varepsilon_t+0.083569\varepsilon_{t-1}+0.26009\sigma^2$ (40.19)* (3.46)* (0.24) (6.76)*

R^2=0.58 ,F=18.57 ,DW=1.97 ,inverted AR root=0.72 , inverted MA root=-0.08 ,*=significant at 5% level.

This series has no structural breaks during the period.

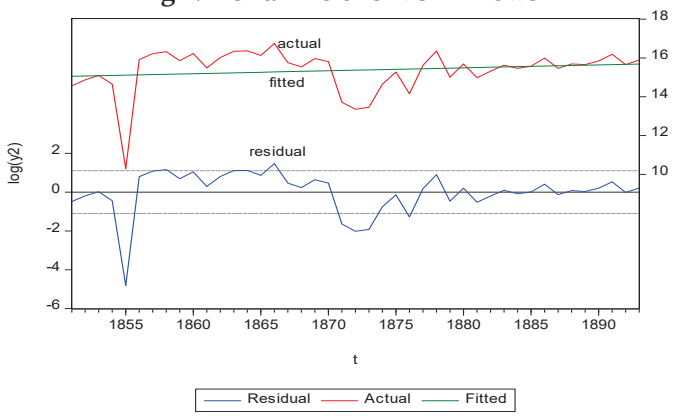
On the other hand, net inflow of silver in India during silver standard from 1851 to 1893 had been stipulating at the rate of 1.51% per year which was insignificant.

$Log(y_2)=15.034+0.015138t$ (43.84)* (1.115)

R^2=0.029 ,F=1.24 , DW=1.36 , y_2=net inflow of silver ,*=significant at 5%.

In Fig-1,the fitted line is shown clearly.

Fig-1:Trend line of silver inflows



Source-Computed by author

The net inflow of silver in India during 1851-1893 is nonstationary but convergent which is shown by ARIMA(1,1,1) model.It is not a good fit yet it is stable.

$Log(y_{2t})=15.363+0.48873log(y_{2t-1})+\varepsilon_t-0.183616\varepsilon_{t-1}+1.0639\sigma^2$

(35.71)* (0.96) (-0.34) (7.32)*

R^2=0.11 , F=1.64,DW=1.96,inverted AR root=0.49,inverted MA root=0.18 ,*=significant at 5% level.

Net inflow of silver has one upward structural breaks in 1857 only.This is verified by Bai-Perron test(2003)in which HAC standard errors and covariance was assumed and trimming 0.15 with maximum 5 beaks is assumed.

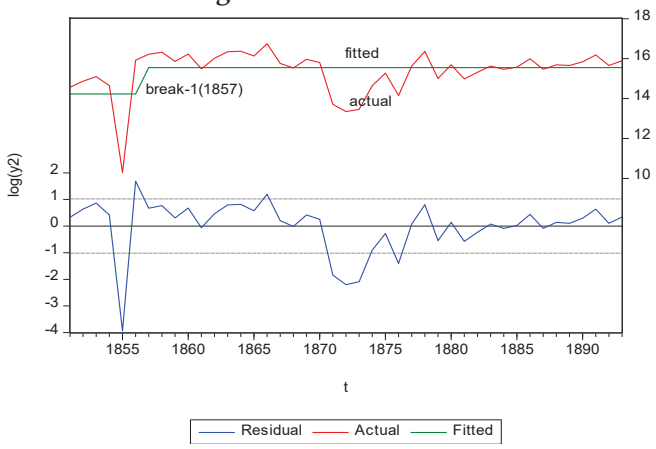
Table-1: Structural breaks of net inflow of silver

Variables	Coefficient	Standard error	T statistic	Prob
	1851-1856=6 obs			
c	14.2328	0.3368	42.25	0.00
	1857-1893=37 obs			
c	15.537	0.218	71.30	0.00

R^2=0.17 ,F=8.64* ,DW=1.62;Source-Computed by author

In Fig-2,the upward structural break is shown clearly.

Fig-2:Structural break



Source-Computed by author

Double log multivariate regression model showed that One per cent increase in GDP,GDP per capita, export, import, gold silver price ratio and net silver inflow led to 12.68% decrease ,19.27% increase,1.89% increase ,1.47% increase,9.93% decrease and 0.13% increase in net inflows of gold per year respectively where relation between gold inflows and GDP,GDP per capita,export, gold silver price ratio are significant at 5% level.

$Log(y_1)$=-19.359-12.683$log(x_1)$+19.275$log(x_2)$+1.89$log(x_3)$+1.47$log(x_4)$-9.938$log(x_5)$+0.1319$log(y_2)$

(-0.56) (-1.99)* (2.86)* (2.54)* (1.53) (-3.35)* (1.35)

R^2= 0.48, F=5.67* ,DW=1.24 , where x_1=GDP,x_2=GDP per capita,x_3=export,x_4=import,x_5= gold silver price ratio,y_2= net inflows of silver

Similarly, one per cent increase in GDP,GDP per capita, export, import, gold silver price ratio and net gold inflow per year led to11.11% fall,12.13% rise,1.86% increase,0.045% rise,1.47% increase and 0.37% increase in net silver inflows in India per year during 1851-1893 in silver standard regime which are all insignificant.

$Log(y_2)$=2.739-11.1162$log(x_1)$+12.139$log(x_2)$+1.86$log(x_3)$-0.045$log(x_4)$+1.47$log(x_5)$+0.37$log(y_1)$

(0.047) (-1.10) (0.98) (1.416) (-0.027) (0.25) (1.35)

R^2=0.24 ,F=1.89 , DW=1.59 ,

To show linear combination of silver inflows with other variables, Johansen Cointegration test suggests that there is no cointegrating vector shown by Trace and Max Eigen Statistic(Table-2).

Table-2:Cointegration test

Hypothesised no of CEs	Eigen value	Trace statistic	0.05 CV	Prob*
None	0.524	113.692	125.615	0.211
At most 1	0.445	83.189	95.753	0.266
At most2	0.412	58.993	69.818	0.267
At most3	0.299	37.219	47.856	0.337
At most4	0.245	22.630	29.797	0.264
At most5	0.236	11.095	15.494	0.205
At most6	0.0006	0.026	3.841	0.87
Hypothesised no of CEs	Eigen value	Max Eigen statistic	0.05 CV	Prob*
None	0.524	30.502	46.231	0.75
At most 1	0.445	24.196	40.077	0.825
At most2	0.412	21.774	33.876	0.625
At most3	0.299	14.588	27.584	0.779
At most4	0.245	11.534	21.131	0.593
At most5	0.236	11.068	14.264	0.150
At most6	0.0006	0.0266	3.841	0.870

*=Mackinnon Haug Michelis(1999) p values

Since there is no cointegration ,The estimated VAR model is given below.

Δx_{1t}=8451.51+0.212Δx_{1t-1}-2.161Δx_{2t-1}+3.10E-06Δx_{3t-1}+1.53E-05Δx_{4t-1}+174.27Δx_{5t-1}-9.07E-06Δy_{1t-1}+7.32E-06Δy_{2t-1}

(3.6)* (1.02) (-0.54) (0.32) (1.27) (1.45) (-0.22) (0.51)

R^2=0.92 ,F=56.29 , AIC=14.47 SC=14.80

Δx_{2t}=313.711-0.025Δx_{1t-1}+0.796Δx_{2t-1}+1.20E-07Δx_{3t-1}+3.32E-07Δx_{4t-1}+7.67Δx_{5t-1}-8.67E-07Δy_{1t-1}+2.37E-07Δy_{2t-2}

(3.97)* (-3.53)* (5.83)* (0.365) (0.807) (1.86) (-0.86) (0.48)

R^2=0.765 , F=15.81 , AIC=7.72 , SC=8.05

Δx_{3t}=-46481278+4953.34Δx_{1t-1}-137563.9Δx_{2t-1}+0.466Δx_{3t-1}+0.068Δx_{4t-1}+4792340Δx_{5t-1}+1.919Δy_{1t-1}-0.355Δy_{2t-1}

(-1.08) (1.27) (-1.84) (2.59)* (0.305) (2.14)* (2.57)* (-1.33)

R^2=0.96 ,F=130.0* , AIC=34.14 , SC=74.47

Δx_{4t}=-1.11E+08+9232.72Δx_{1t-1}-84374.41Δx_{2t-1}+0.084Δx_{3t-1}+0.3377Δx_{4t-1}+3264343Δx_{5t-1}+0.2086Δy_{1t-1}-0.235Δy_{2t-1}

(-3.92)* (3.61)* (-1.72) (0.713) (2.29)* (2.21)* (0.425) (-1.33)

R^2=0.98 , F=247.81* , AIC=33.3 , SC=33.63

Δx_{5t}=4.0918-8.24E-05Δx_{1t-1}+0.00176Δx_{2t-1}+4.27E-09Δx_{3t-1}-2.07E-08Δx_{4t-1}+0.716Δx_{5t-1}-6.34E-08Δy_{1t-1}+1.22-E08Δy_{2t-1}

(1.8) (-0.401) (0.439) (0.45) (1.75) (6.06)* (-1.73) (0.908)

R^2=0.97 , F=212.09* , AIC=0.629 , SC=0.96

Δy_{1t}=-8108862+636.61Δx_{1t-1}+4042.18Δx_{2t-1}-0.0215Δx_{3t-1}-0.00204Δx_{4t-1}-76501.53Δx_{5t-1}+0.8244Δy_{1t-1}+0.033Δy_{2t-1}

(-0.81) (0.708) (0.23) (-0.51) (-0.03) (-0.14) (4.78)* (0.54)

R^2=0.67 , F=10.28 , AIC=31.21 , SC=31.54

Δy_{2t}=-63316662+3366.48Δx_{1t-1}+311.52Δx_{2t-1}-0.034Δx_{3t-1}-0.204Δx_{4t-1}+1705435Δx_{5t-1}+1.036Δy_{1t-1}+0.235Δy_{2t-1}

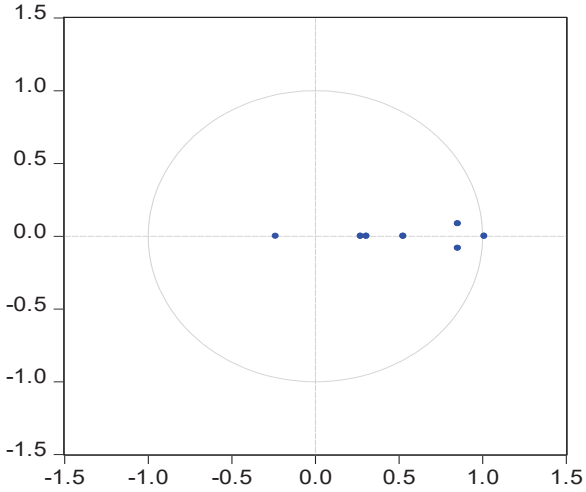
(-2.56)* (0.50) (0.007) (-0.33) (-1.58) (1.3) (2.42)* (1.53)

R^2=0.42 , F=3.63 , AIC=33.03 , SC=33.36 , *=significant at 5% level

The estimated VAR model states that [i] change of GDP per capita is negatively related with change of previous period's GDP and positively related with previous period's GDP per capita,[ii] change of export is positively related with change of previous period's export,ratio of gold and silver price,change of gold inflows,[iii] change of import is positively related with change of previous period's GDP,import and gold silver price ratio,[iv]change of gold and silver inflows are positively related with their previous period .Other relations are insignificant.

This VAR model is unstable because one of its 7 roots is greater than one ,two roots are imaginary and 4 roots are less than one (,ie 1.012998,0.853108±0.084339i,0.527198, 0.307550,0.272081),so all roots do not lie inside the unit root circle.It is seen in the Fig-3

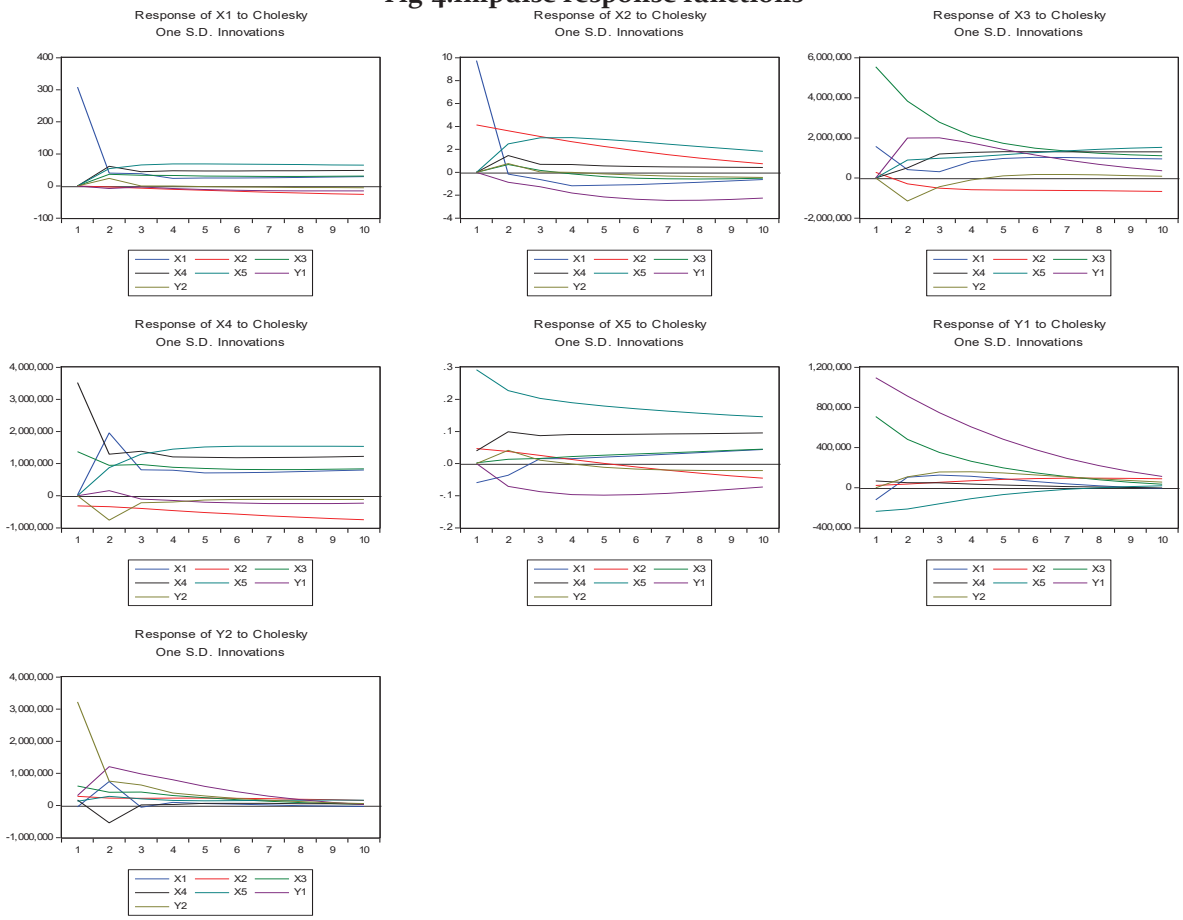
Fig-3:Inverse roots of AR characteristic polynomial



Source-Computed by author

The impulse response functions are diverging so that it is nonstationary and unstable.The exogenous shocks could not tend the model into equilibrium.

Fig-4:Impulse response functions



Source-Computed by author

The residuals test of VAR model assures that the VAR model has problems of autocorrelations which is seen in the Fig-5.

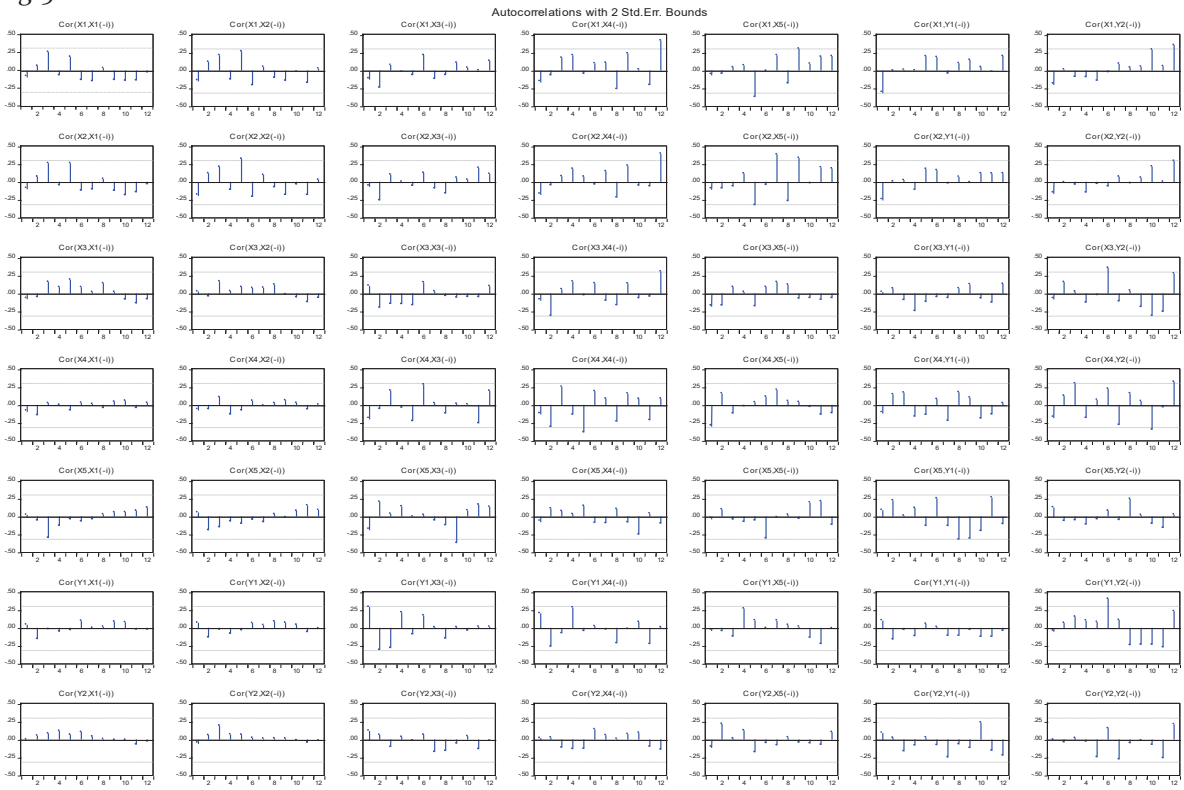


Fig-5:Problem of autocorrelation

Source-Computed by author

The Doornik-Hansen Normality test showed that some component values of Chi-squares of skewness and kurtosis are insignificant and some components of Jarque Bera are also insignificant, therefore normality test is rejected at 5% level. In Table-3,the values are arranged.

Table-3:Normality test

Component	Skewness	Chi-square	df	Prob
1	-1.02516	7.3394	1	0.0067
2	-0.34504	1.030359	1	0.3101
3	0.000458	1.89E-06	1	0.9989
4	-0.37256	1.194456	1	0.2744
5	0.969224	6.701514	1	0.0096
6	-0.743477	4.278805	1	0.0386
7	0.676342	3.621130	1	0.0571
Joint		24.16574	7	0.000
Component	Kurtosis	Chi-square	df	Prob
1	5.462538	1.625122	1	0.2024
2	5.194797	12.01844	1	0.0005
3	4.744478	10.74461	1	0.0010
4	4.830324	8.96958	1	0.0027
5	4.980636	0.854511	1	0.3553
6	3.544591	0.027912	1	0.8673
7	4.384803	2.246676		0.1339
Joint		34.48682	7	0.000
component	Jarque Bera	df	Prob	
1	8.96495	2	0.0113	
2	13.04880	2	0.0015	
3	10.74461	2	0.0046	
4	10.16400	2	0.0062	
5	7.556024	2	0.0229	
6	4.306717	2	0.1161	
7	5.867806	2	0.0532	
Joint	60.65256	14	0.000	

Source-Computed by author

Limitation and future scope of research: In this paper, the data of GDP and per capita GDP of India have been calculated from 1851-1883 on the basis of constant growth rates which were collected from Maddision(2006) to fit them into long term time series from 1851-1893.If the model is compared to other monetary systems in India or China, then a good comparative study would be achieved. However, there is ample scope for future research in this area of study.

Criticism: The act of 1835 made silver rupee weighing 180 gms or 11/12th fine(containing 165gms of fine silver) in unlimited legal lender including demonitisation of gold coins but act of 1841 introduced gold mohurs acceptance in public treasuries at the rate of 1:15.After 1850 production of silver tended to fall and currency famine intensified Indian economy.In 1861,paper currency act passed and paper currency began to circulate. In 1874,government declared £1=Rs10.5 and government adopted gold currency which led to fall the price of silver from 58 pence to 37.5 pence and to 27 pence in 1899 in which rupee sterling rate declined from 2s(in 1872) to 1s2d in 1892 and India government faced a loss of 154 crores of rupees during 1875-89.In 1892,coinage of silver suspended and introduced £1=Rs15, or Rs1=1s4d ,and in 1893 the silver standard was abandoned. In Table- 4,it is shown that gold production rises with its rising price compared to silver including their index numbers during silver standard period from 1851 to 1892 which accelerated to demolish silver standard from India.

Table-4:Silver and gold production and price ratios.

	Ratio of gold production to silver production	Ratio of value of gold and silver	Index no. of production ratio	Index no of value of gold and silver
1851-1855	4.4	15.45	13.8	103.3
1856-1860	4.5	15.28	14.0	102.2
1861-1865	5.9	15.42	18.55	103.1
1866-1870	6.9	15.52	21.7	103.8
1871-1875	11.3	16.10	35.5	107.6
1876-1880	13.2	17.79	41.5	119.0
1881-1885	17.3	18.81	54.4	125.8
1886-1890	19.9	20.98	62.6	140.3
1891-1895	20.0	26.75	62.9	178.9

Source-Ambedkar(1923): Sir, R.Giffen remarked before the Fowler commission that India has abundant gold supply and in 1868, Sir R. Temple concludes to follow gold as legal tender. From 1870-1876,a fall of silver value prompted Bombay Chamber of Commerce recommended gold standard. Smith committee also proposed to follow gold standard. The spokesmen like Giffen,Mallet,Farrer,Welby to Herschell committee (1893)were in favour of introduction of gold standard in India.

Viena congress(1859),Barlin congress(1863),Paris conference (1867) proclaimed stability, uniform coinage,gold as the principal currency.In 1871,Germany passed gold standard,in 1872, Norway,Sweden, Denmark went to gold standard,in 1873 Belgium suspended silver standard,in 1879,Austria did the same, in 1873 USA passed gold standard and in 1878 Latin America suspended silver standard. During 1870-93 there was over supply of silver and silver price in terms of gold depreciated. Fisher also opposed to double standard with double coinages. England ultimately dominated world trade and finance in her favour adopting gold standard. But alas! India remains in gold exchange standard from 1893 onwards. Sterling was convertible to gold, rupee was convertible to sterling but rupee was not convertible to gold.

Capital inflows did not favour silver standard during 1851-1893 because one percent increase in gold inflows per year led to 0.65 decrease in GDP,0.68% decrease in GDP per capita,9.62% increase in export and 1.75% increase in import per year respectively which are all insignificant. On the other hand, one per cent rise in silver inflow per year led to 1.13 % increase in GDP, 0.0012% decrease in GDP per capita , 13.45% increase in export and 12.03% increase in import per year respectively all of which are insignificant. Although, GDP ,export, import, gold silver price ratio had been increasing at the rates of 0.52%,9.14%,5.16% and 0.77% significantly per year respectively during the silver standard from 1851 to 1993.Therefore,instability of the silver standard in macroeconomic fundamentals is clear and the relations among them with capital flows were improper.

B.R.Ambedkar (1923) was dead against these outcomes of the silver standard in which the acts and laws were imposed during the silver standard by the British government although he fought for gold standard which was not introduced rather gold exchange standard was imposed in India from 1893.

Conclusion: The paper concludes that gold inflows during 1851-1893 had decreased at the rate of 0.34% per year insignificantly but it was nonstationary,convergent and had no structural breaks.Silver inflows during 1851-1893 had increased at the rate of 1.51% per year insignificantly and found nonstationary and convergent and had one upward structural break in 1857.No cointegration among gold or silver inflows with GDP,GDP per capita,export,import and gold silver price ratio was found during 1851-1893 where VAR model was unstable and nonstationary and impulse response functions were diverging.Semi-log linear regression model among silver inflows and gold inflows with those variables were also insignificant although GDP,export,import,and gold silver price ratio had been increasing at the rates of 0.52%,9.14% ,5.16% and 0.77% per year significantly.But double-log linear regression model suggested that gold inflows had significant impact from GDP,GDP per capita,export,and gold-silver price ratio but had no significant impact of silver inflows from those variables during 1851-1893 respectively.Yet,there is bidirectional causality among gold inflows,GDP,GDP per capita,export,import and gold silver price ratio significantly during the given period.Even,there were sharp depreciation of rupee sterling rate,silver price and production and gold price increased with production during the silver standard regime.Thus,gold and silver inflows could not synthesize the silver standard more effective in macro-dynamic adjustment during 1851-1893 although the series of managerial experiments of the commissions and government are equally responsible

for instability of the silver standard in India which was equally identical with gold standard in England

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