

Commodity Derivatives and Risk Management
Professor Prabina Rajib
Vinod Gupta School of Management
Indian Institute of Technology Kharagpur
Lecture 28
Introduction to Gold and Gold Derivatives

Welcome to this session on commodity derivatives and risk management and today we are going to discuss different derivative contracts pertaining to gold. So like any commodity session, let us first understand what we mean by gold, spot market and who are the major players or in the gold market and then we will be going to into discussing what are the major derivative contracts. Exchange traded derivative contracts on gold as well as forward contracts and OTC contracts signed by gold producers and others. But if you recall last class, I was supposed to discuss about the crack spread and because of the lack of connectivity to the internet; I could not give you the example or show you the example. I will just take a 1 minute to show you that example on crack spread and then today we will start the discussion on gold.

(Refer Slide Time: 1:47)

CME Group

Search CMEGroup.com

CME Group » Resources » Conversion Calculator

[an error occurred while processing this directive]

Conversion Calculator

General | **Crude Oil** | Refined Products | Natural Gas | Coal | Crack Spreads | Spark Spreads | Metals

Crack Spreads

The crack spread represents the theoretical refining margin. If a crack spread is a positive number then the price of the refined products is higher than that of crude oil, the raw material, and the spread is profitable. If the spread is a negative number, the products are priced at less than the cost of crude and are not profitable.

The 3-2-1 crack spread is a commonly used formula in the oil industry, expresses the theoretical margin in dollars per barrel

1 X (Heating Oil: \$ 1.42 per gallon x 42)	
2 X (Gasoline: \$ 1.50 per gallon x 42)	
minus 3 X (Crude Oil: \$ 46 per barrel)	
Calculate	
Crack Spread: \$ 15.88 per barrel	

1 X (Heating Oil: \$ per gallon x 42)	
minus 1 X (Crude Oil: \$ per barrel)	
Calculate	
Crack Spread: \$ per barrel	

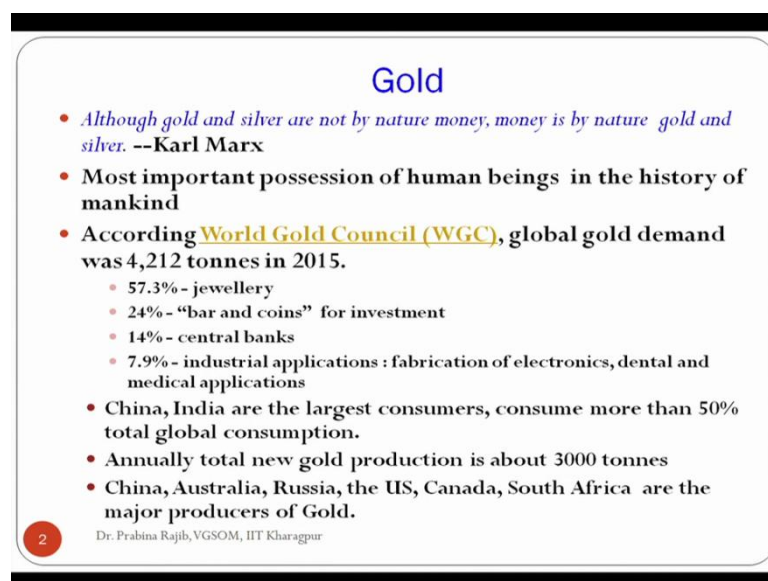
1 X (Gasoline: \$ per gallon x 42)	
minus 1 X (Crude Oil: \$ per barrel)	
Calculate	
Crack Spread: \$ per barrel	

Okay I hope you can see the screen now this particular screen which is from the Chicago Mercantile Exchange, CME and this shows the crack spread calculation and let us focus on this panel that is your 3 is to 2 is to 1 crack spread, so if you can see the 3 is to 2 is to 1 crack spread is calculated with respect to 3 crude oil price, prices of 3 crude oil like somebody is buying 3 barrels of crude oil and 2 barrels and gasoline and 1 barrel of heating oil. So I have just given these details dollar 46 per crude oil, 1.50 per gallon of gasoline which is multiplied

by 42 gives us 1 barrel of gasoline. Similarly 42 gallon of heating oil so all this I have given so when I give this, so it is coming to 15.88 per barrel.

Let me change let us say this one I make it let us say 44 or 42, let us see how much is so you have 19.88 because the refiner is going to get a higher margin when heating oil price and gasoline price remains unchanged and crude oil price goes down. And let us go to another price, let us say we go into 56, what happens to our 56, crude oil crack spread is coming to dollar 55.88 a barrel. Similarly you can have crack spread can be calculated for 1 crude oil vis-à-vis the 1 heating oil, you can have 1 crude oil vis-à-vis 1 gasoline so and so forth.

(Refer Slide Time: 4:00)



Gold

- *Although gold and silver are not by nature money, money is by nature gold and silver. --Karl Marx*
- **Most important possession of human beings in the history of mankind**
- According **World Gold Council (WGC)**, global gold demand was 4,212 tonnes in 2015.
 - 57.3% - jewellery
 - 24% - “bar and coins” for investment
 - 14% - central banks
 - 7.9% - industrial applications : fabrication of electronics, dental and medical applications
- China, India are the largest consumers, consume more than 50% total global consumption.
- Annually total new gold production is about 3000 tonnes
- China, Australia, Russia, the US, Canada, South Africa are the major producers of Gold.

Dr. Prabina Rajib, VGSOM, IIT Kharagpur

Okay now let us start our today's discussion on gold. So as you recall, I mean all of is a very important part of every person's investment portfolio. Specifically every Indian so every household has some amount of gold either in jewelry form or in coin or bar form and it is not only the gold is not only important for Indian people, it is also equally important since time immemorial from for all human being. In fact, a Carl Marks, Cark Marks mentioned that although gold and silver are not by nature money, money is by nature gold and silver so the importance of gold can be understood from this particular statement that gold and silver may not be may not be by nature money but money by nature is gold and silver and we will understand this the importance of this statement in far greater detail as we go along in our discussion about various aspects of gold.

And as I have mentioned, it is most important possession of human beings in the history of mankind and the World Gold Council, it is the one of the important body with respect to

information pertaining to gold so any information related to production, the consumption, the all all interesting dimension with respect to gold is available at this World Gold Council website, so if you-you spend some time more on seeing what information these particular website provides. So as per this particular website information, global demand for gold is around 4000 tons. On every year almost it hovers around 4000 tons and to be precise, it was 4212 tons in the year 2015 and how this particular how this 4222 is used, a majority portion of gold is used in terms of jewelry and followed by investment purpose in the forms of bars and gold coins and central banks of almost all countries hold some hold gold as part of their reserve.


And central banks are the third largest categories of investors and only 8% of the gold is used by industrial application. So if you can see in the slide, around 57.3% jewelry, 24% is for bar coins which is used predominantly for investment and 14% is used by central banks and 8% is for industrial applications, mostly fabrication of electronics and dental and medical applications. And it is no secret China and India are the largest consumers of the gold and they consumer more than 50% of the total gold consumption and globally, total new gold production is around 3000 tons.

Again on an average, total new gold which gets mined from the earth's surface, it is around 3000 tons so where does this additional 4200 tons come from? This is the old gold which gets recycled. Now, coming to which are the major countries which produce a gold? You have China, Australia, Russia and US, Canada and South Africa are the major producers of the gold and if you if you know India does not product gold in any in any manner. In fact the Kolar Gold, one which is the only one gold mining company stopped its operation in the year 2001. In between there was some discussion regarding reviving the company with when the gold price went up to around dollar 700 per ounce but not major activity has been done to revive this company and India remains almost zero producer of gold.

(Refer Slide Time: 9:16)

Allure of Gold

- It is considered as
 - hedge against inflation
 - safe haven investment
- Hedge against inflation
 - World Gold Council conducted a study in USA market considered data for 35 years during 1974 to 2008, based on annual *consumer price index (CPI)* data, inflation was low, medium and high for 6, 21 and 8 years respectively. The study reported inflation adjusted positive gold returns in all these years.



Rabina Rajib, VGSOM, IIT Kharagpur

Of course some of the copper mining companies produce gold but the amount of gold which is produced by these Indian companies is next to nil. Now, why I mean why are we so much interested in holding a gold and it crosses across countries, it crosses across religion and so the one of or couple of the most important reason for holding gold is the hedge against inflation and gold acting as a safe haven investment so what do we mean by hedge against inflation? Okay before I go into discussion of this; let us understand something called a nominal interest rate and a real interest rate.

If when we make a fixed deposit in a bank, we get around 8% or 8.5% per annum in our fixed deposit in INR rupee deposit rupee denominated deposit and that is our nominal interest rate so that is what bank is going to give but in the mean time, let us say the inflation is hovering around 10% so what happens to our real rate of return, real rate of return is if 8.5% is the nominal interest and inflation is 10%, our real return is negative 1.5%. So the return from the gold has always remained positive irrespective of whatever has happened to the inflation and this has been researchers have studied this aspect in many countries across many time periods and they have found out that the inflation adjusted return in gold investment has remained positive.

For example, this particular study which was conducted by World Gold Council which analyze the consumer price index for 35 years in USA ranging from the year 1974 to 2008. they found out that the out of these 35 years, 6 years was termed as low inflation years. 21 years medium and 8 years were high inflation and in all these 3 different categories of inflation period, the CPI adjusted gold return remained positive.

(Refer Slide Time: 12:08)

Gold as an Investment Asset

- Safe Haven asset
 - gives a better return when all other assets are performing poorly
- Baur and McDermott (2010) tested the gold's safe haven role
 - Considered stock index of 13 countries spanning over 30 years during 1979-2009 and found that gold does act as a safe haven asset in all these countries in varying degrees.



Rabina Rajib, VGSOM, IIT Kharagpur


And the second reason which is which is very important for many people to hold gold is the safe haven asset, so what do you mean by safe haven, safe haven asset means when no other asset is giving us a better return, gold is giving us a better return so if you recall whenever recession happens, you are not getting good return in from any the housing sector is not the prices of real estate is not moving, your stock market is not moving and bond market is also not giving you good returns so everything is in declined phase but one asset which gives you a better return compared to other investment is your gold. So gold tends to perform well, gold tends to have a negative correlation with economic activity so whenever economy is in a poor state, if people have invested in gold, they will they get better return.

So this particular study which you can see in given in the PPT, Baur and McDermott in 2010 conducted a survey and they proved those self they proved the safe haven aspect of gold. So they considered the stock index of 13 countries spanning over 30 years during 1979 to 2009 and found that gold acts as a safe haven asset in all these countries in among in all these years in varying degrees.

(Refer Slide Time: 13:52)

Gold as safe haven asset

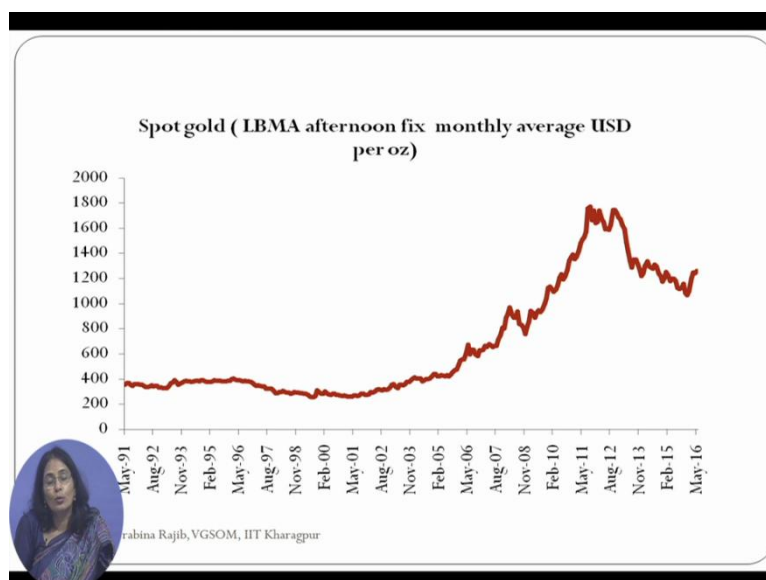
- Mccown and Zimmerman (2006) analyzing data for 33 years for period covering 1970-2003, they found that **gold returns are slightly higher than Treasury Bills return.**
- They also found that **gold has zero beta.**



Rabina Rajib, VGSOM, IIT Kharagpur

There is also another which considered a longer period of 33 years in USA and found out the this study reported that gold returns are slightly higher than treasury bill return and gold also have a zero beta, that means irrespective of movement of stock market, gold gives a a constant return. Now, let us go to analyze how the stock gold price has moved from year on year.

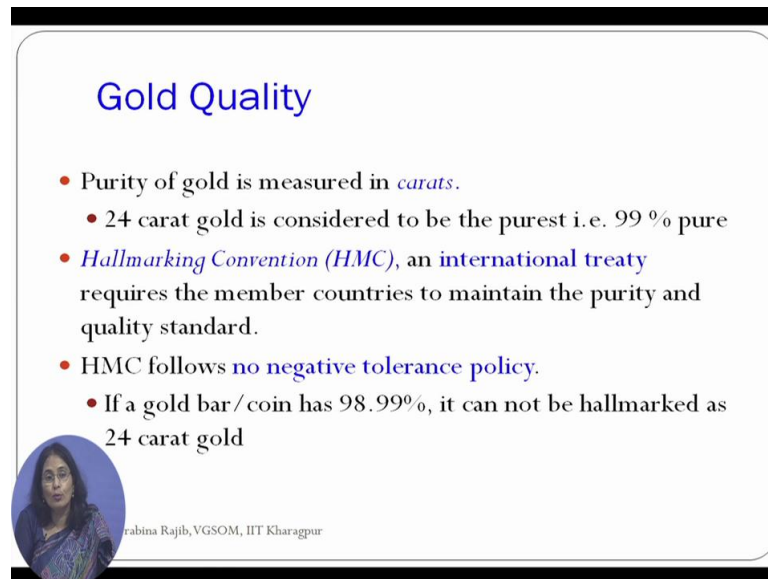
(Refer Slide Time: 14:25)



This particular data, again I have downloaded from the Bloomberg, this is the price spot price prevailing at London Bullion Market Association and this is the monthly average price of afternoon fix so what is that afternoon fix, we will discuss little later so if you can see that gold price hovered around 200 to or below 400 dollar for considerable period of time from


April 1991 to almost August 2002 and slowly-slowly it started picking up and it picked it reached around dollar 1744 sometimes around September 2012 and after that the gold has come down and it is hovering around dollar 1200 couple of days back.

(Refer Slide Time: 15:37)



Gold Quality


- Purity of gold is measured in *carats*.
 - 24 carat gold is considered to be the purest i.e. 99 % pure
- *Hallmarking Convention (HMC)*, an **international treaty** requires the member countries to maintain the purity and quality standard.
- HMC follows **no negative tolerance policy**.
 - If a gold bar/coin has 98.99%, it can not be hallmarked as 24 carat gold

 Rabina Rajib, VGSOM, IIT Kharagpur

And I will also discuss a little bit about gold quality. All of whenever you go to buy gold from gold shops, they ask they may be showing you a price of 24 carat and 22 carat so what do you mean by this carat? Carat measures the fineness or the purity of the gold and 24 carat gold which is considered to be the best kind of a gold has 99, it is 99% pure so that means if you are buying 1 kg of gold which is of 24 carat that means you will have the gold bar of 1 kg must have 990 grams of gold, so that means 10 grams can have can be of any other metal but 990 grams would be gold. Similarly you have okay this who gives these who has measures for quality of the gold.

(Refer Slide Time: 17:04)

Gold Carat, Gold Content and Fineness					
<i>Purity in Carat</i>	Gold content (wt. %)	Fineness	<i>Purity in Carat</i>	Gold content (wt. %)	Fineness
24 carat	99	990	15 carat	62.5	625
23 carat	95.83	958.3	14 carat	58.5	585
22 carat	91.6	916	10 carat	41.7	417
20 carat	81.3	813	9 carat	37.5	375
18 carat	75.0	750			



Rabina Rajib, VGSOM, IIT Kharagpur

There is a all of you must have heard something called Hall marking. It's a Hall marking is a convention and it is a international treaty which requires the member countries to maintain the purity of Gold which has which is being bought and sold in the market. And let us so 24 carat as I mentioned, it should have a 99% purity should be gold. Similarly 22 carat was 91%6, 18 carat will have a 75% as a pure gold and different other carat is mentioned so let us not go into these details. So one thing I would like to mention here that if you go and buy and buy a gold jewelry which says that it has got 22 carat so if you are buying 10 gram worth of gold jewelry and it is saying that 22 carat so that means 9.16 gram out of this 10 grams should be a pure gold.

Only then this particular piece of jewelry can be hall marked as 22 carat. It will be never be hall marked as 24 carat. It will also not be hall marked as 20 carats. It will be hall marked as 22 carat only when it has got 9.16 grams of gold 9.16 gram as pure gold so remaining 84.84 grams can be of silver or copper or any other metal but minimum gold should be there in 10 gram jewelry is 9.16 gram.

(Refer Slide Time: 18:34)

Sources of Gold

- Mine production
- Recycled gold through scrap sales
- Gold sales by central banks & other supranational organizations like *International Monetary Fund (IMF)* and *European Central Bank (ECB)* etc.



Dr. Prabina Rajib, VGSOM, IIT Kharagpur

Now, where does this gold come? As we mentioned that predominantly the gold is a new gold around 3000 ton on an average gets mined and another portion comes from the recycled gold through scrap sales and that means old gold sale and also another interesting part, the gold sales by central bank and other supranational organizations like International Monetary Fund and European Commercial Bank. So at times these banks can sell gold so if they are selling the gold then they becomes supplier of the gold but normally since last couple of years whenever we are seeing or discussing about the gold, we know that many central banks of many countries are acquiring gold.

(Refer Slide Time: 19:31)

Gold Supply

Total Supply of Gold During 2007-2012						
(in Tons)	2007	2008	2009	2010	2011	2012
Source						
Total mine supply	2029	2057	2450	2540	2847	2828
Old gold scrap	982	1316	1668	1653	1669	1626
Official sector supply (*)	484	232	41	-87	-457	-535
Total supply	3495	3605	4025	4108	4582	4405

(*) Official sector supply is positive when central banks/IMF/ECB are net sellers of gold. It is negative when they are net buyers of gold.

10 Dr. Prabina Rajib, VGSOM, IIT Kharagpur

So this is some statistics. If you see 2001 to 2012, total supply hovers from started at 2007, it is 3495 tons to it is hovering around 4405 tons in 2012 and if you see official sector supply is - 457 and - 535 in 2011-12 respectively so that means these central banks have been net purchaser of the gold. If they are net seller of the gold, they will be supplying gold and if they are net purchaser of the gold then they will be buying gold from the market.

(Refer Slide Time: 20:22)

Gold demand

- Central banks
- Industry
- Individuals
 - **Dhanteras and Akshaya Tritiya**
- Trusts and various religious bodies.
- Exchange Traded Funds (ETFs) & similar investments.



Rabina Rajib, VGSOM, IIT Kharagpur

Now, which sector demands the maximum amount of gold so gold demand comes from the central banks. We have discussed industry also consumes but only a small portion to the tune of 8% and a majority of gold is consumed by individuals in terms of jewelry or a bar and coin form. In fact in India, you have to 2 specific days which are year marked for buying gold that is your Dhanteras and Akshaya Tritiya so in that, these 2 auspicious days, most Indians buy gold and similarly, Chinese people also have some specific days year marked in a year they also prefer to buy gold on those days.

Now, one interesting thing I thought of sharing with you all as nowadays in finance and investment, we talk about SIP, that is your systematic investment plan so mutual fund companies tell us what is the benefit of systematic investment plan. So if you are continuously investing and regularly investing in a particular product, you may buy the same buy the underlying some year at a high price, some year you are going to buy at a low price and on an average, your purchase price is going to be lower than if you are trying time the market.

In fact if you see, this Dhanteras and Akshay Trutiya is nothing but a SIP, systematic investment plan which has every year, it kind of a forced it was kind of a on unofficially or culturally these 2 days has been identified so that every year, Indians buy gold and hold gold. Of course many people say that gold is a dead investment, gold is it does not give us return. Specifically, gold jewelry does not give us any return which is true but if you see why Indians have invested in a gold, there is a reason for it.

So and what is the reason, in my view, if you analyze, I do not know what is whether you have ever gone to a rural village of India, there would be 5 to 6 kilometers vicinity, you will not have a bank or any post office so where do people save? What do how do they save? What kind of instrument they have in for saving? Because you need to have some saving for your kid's marriage, for your kid's education, for health, for health related expenses. If there is a death in your family, again, all the rituals associated with death so you need to have some asset which is liquid.

And you do not have why do, what do you do so that saving gold and the psyche of Indian gold, why do they save? Lot of people analyze, comment negatively but I have very strongly, I feel that this is the reason why when you do not have any investment opportunity which is liquid, you tend to go and you tend to go and invest in a asset which is considered to be liquid even if it is not giving you any return. And how gold jewelries have been liquid investment? I am sure every small market in a nearby in a village also, you will have a jeweler, small jeweler and if you take gold jewelry, instantaneously, they will do some testing and they will find out whatever the amount of the gold.

They may cheat you, the likelihood of you getting cheated could be high but still at least have a opportunity or you have a avenue where you can go and may be give your gold jewelry lend your gold jewelry for some days and if you require a money, that particular person, the neighborhood jewelry is going to give you finances for some time to come. So gold has been the one of the most liquid asset for Indian people and also without any bank, without any alternate investment opportunities, people will people have invested in gold and this is going to continue to be that till a situation when you have you have access to the regular banking channel. If you have some sur+ cash, you go and make a fix deposit, probably that is the time when the appetite for gold investment by Indian people, it will go it is going to go down. Till such time, it is not it is not going to go down.

And prime minister's there is initiative of Jan Dhan Yojana making bank accounts available and bringing people the banking sector is a very important direction in this step because even if government of India wants to say that we are going to import less gold and all what, whatever they may say, there is going to be a demand for gold and if there is going to be a demand for gold, there will be other channels by which people will be bringing gold, that is through the black market of gold.

(Refer Slide Time: 26:26)



Gold demand

- Central banks
- Industry
- Individuals
 - **Dhanteras and Akshaya Tritiya**
- Trusts and various religious bodies.
- Exchange Traded Funds (ETFs) & similar investments.

11 Dr. Prabina Rajib, VGSOM, IIT Kharagpur

And in this context, I would also like to show you one particular piece of jewelry, this is a picture and if you see, this is called most Indian ladies wear these. Some places, it is called a Kasumala, and some places, it is called a Mangalsutra and if you see these gold coins which are in the picture gold coins which are in the picture, these gold coins can be can be strung at any point of time so as and when ladies had some extra cash available, they were going and buying gold and putting it in their in the necklace so that it also becomes as and when you have some sur+ cash, you are building up a liquid asset.

And why the concept of having that mangalsutra and you do not take it out from your body and it is considered on inauspicious for married ladies to remove the mangalsutra, it is nothing to do with Indian ladies loving their spouses more or less, so it is a Stree dhan. Indian ladies never have had access to the parental property and in case of any untoward situation happens so this particular gold jewelry is their own asset, own property which is now owned by probably by this husband and probably by any other family member.

The word stree dhan so that comes from predominantly in form of gold jewelry so that is the reason why Indian women have been buying gold and wearing gold and also why do continuously wear and do not take it out because the moment you take it, probably your in-laws or your husband or any family member, there is a chance of they take out and take them and sell sell them in the market so make a we have a story around it and through ages of course, it is not a 1 lady or 1 woman who has done it, so we have a story around so that it so that it is inauspicious to sell mangalsutra, inauspicious to sell these family heirlooms and jewelries, etc.

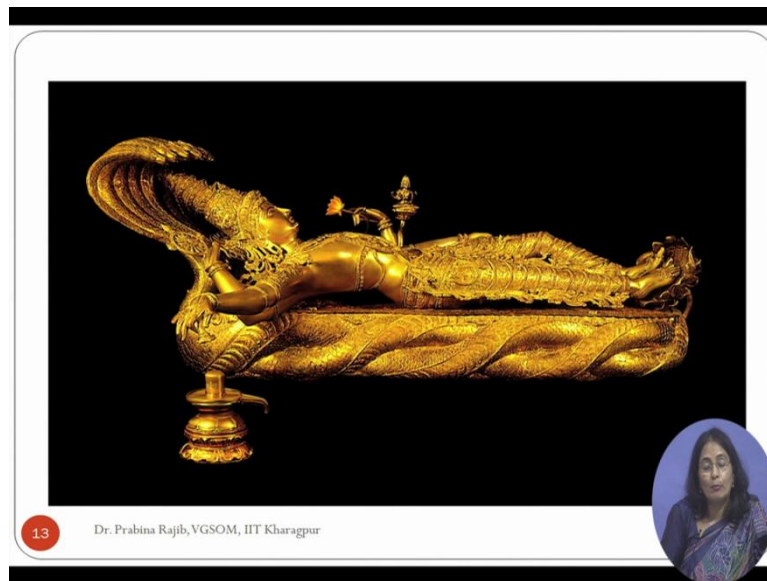
And in this context, I would also like to say trust and religious bodies are also very important organizations who demand gold. And they do not buy gold, there are lot of people invest gold so they are they are one of the largest gold the amount of gold these trust and religious bodies have are huge amount. All of you may be knowing the exact quantity of the gold I am not able to recall at this point of time Tirumala Devasthanam and of late recently Shirdi Saibaba and many other temples have lot of gold jewelry so there is also another source which is has a demand for gold that is your exchange credit fund so we will be discussing about the exchange credit fund little later.

(Refer Slide Time: 29:56)

Central Banks	
Official Gold Reserves (in Tons)	
Country	Gold held by Central Bank (in Tons)
USA	8,133.5
Germany	3,391.3
IMF	2,814.0
Italy	2,451.8
France	2,435.4
China	1,054.1
India	557.7
Source: world Gold Council	

So when it goes to central bank, please see this particular slide, this official gold reserve by in tons of gold, USA has a largest reserve of 8133.5, all this data have downloaded from the world gold council and India has 557.7 tons of gold. This is official reserve. Of course, Indian people are as per the some statics available, Indian household have around 2500 tons of gold with them.

(Refer Slide Time: 30:38)



And when I was talking about Indian temple holding gold, I am sure I do not know how many of you will be able to recollect this particular picture. If you recall this Padmanabhswami temple of Kerala when a couple of years back when they opened some of the rooms which were closed for 100s of years, so they found out many precious stones, gold jewelry, gold coins etc but one of the most beautiful piece of single largest piece of gold item which they recovered is this idol of Vishnu and it weighs around 32 kg. And, why have I brought in this particular picture is that this is one of the finest workmanship in terms of if you see the kind of a body structure, the kind of design it is unparalleled. So it is it shows the quality of workmanship of Indian jewelers and somehow probably we have never been able to make initiative on making handmade jewelry a big brand from India.

(Refer Slide Time: 32:51)

Gold ETFs

- Gold ETFs are mutual funds where the units are backed up by physical gold
- Each ETF unit gives the owner a specific amount of gold ownership.
- These ETFs trade in exchanges and holders of the ETFs can buy and sell these units from the secondary market.
- *Net asset value (NAV)* of the ETF is governed by the current price of the gold.
- Asset under management in ETF increases when gold price increases.

14

Dr. Prabina Rajib, VGSOM, IIT Kharagpur

And I personally feel the jewelers jeweler karigars from India, mostly from may be Orissa that filigree work, silver filigree gold filigree work and jewelers from karigars from Kolkata's workmanship is par excellence. Of course, I am from this part of India so that's why I am little probably biased. I am sure the workmanship all over the world, all over the India is par excellence and may be as part of the skill India initiative, this jewelry making, handmade jewelry making could be something worth. Government can consider it as a bookie of skill which Indian youth could be trained. So with this, we will be ending our today's session and we will continue with our next session in the discussion of the gold ETFs, Thanking all of you.