# Compare Ontario returns to NY, CA, MA allowed returns on equity.

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# Key output: Annual average returns for electric utilities in Ontario,

# California, Massachusetts, New York. This file is written as

# a .csv for use in Excel

# Chart 1. Line plot of awarded ROEs for the particular states, 50 us states,

# Alberta & BC. Adjusted for taxes & leverage.

library(tidyverse)

library(readxl)

library(lubridate)

library(ggpubr)

# Color palette for plots.

colPalette <- c("#156082", "#E97132","#196B24", "#0F9ED5", "#A02B93",

 "#4EA72E", "#E69F00", "#CC79A7")

# Load US and Canadian authorized return data downloaded from SNL

rDir<-"C:/Users/frank/OneDrive/Ontario Energy Board/R\_analysis/Rdata"

rawDir<-"C:/Users/frank/OneDrive/Ontario Energy Board/R\_analysis/Raw"

csvDir<-"C:/Users/frank/OneDrive/Ontario Energy Board/R\_analysis(final)/csvFiles"

# Load the SNL utility authorized return data.

load(paste(rDir,"usSNL.Rdata",sep="/"))

load(paste(rDir,"caSNL.Rdata",sep="/"))

# Load the interest rate data.

load(paste(rDir,"CA10.Rdata",sep="/"))

load(paste(rDir,"DGS.Rdata",sep="/"))

# Load the corporate tax rate data

cit<-read\_xlsx(path=paste(rawDir,"CorporateTaxRates.xlsx",sep="/"),

 sheet="Corporate\_Tax\_Rates",skip=3)

names(cit)<-c("yrAuth","cait","usit")

# Clean the US data.

# Eliminate Limited Issue Riders

# Eliminate Illinois

# Authorized ROE>0.

# Electric cases

DERatioDeemed<-1.5

usfile2<-usfile%>%

 mutate(ym1=as.POSIXct(ymd(paste(year(AuthDate),month(AuthDate),"01",sep="-"))))%>%

 left\_join(cit,by="yrAuth")%>%

 left\_join(DGS,by=c("AuthDate"="observation\_date"))%>%

 left\_join(CA10,by=c("ym1"="observation\_date"))%>%

 filter(!(state=="IL" & service=="Electric"),

 reqROE>0,

 AuthROE>0,

 ReqEqRatio>0,

 AuthERatio>0,

 service=="Electric",

 CaseType!="Limited-Issue Rider")%>%

 # Create unlevered & relevered ROEs

 mutate(authROE\_1=AuthROE/100,

 authE2cap\_1=AuthERatio/100,

 dgs10\_1=DGS10/100,

 ca10\_1=CA10/100,

 DERatio=(1/(authE2cap\_1))-1,

 ROEU\_1=((authROE\_1+DERatio\*(1-usit)\*(dgs10\_1))/

 (1+DERatio\*(1-usit))),

 ROEU=ROEU\_1\*100,

 #ROEL=100\*(ROEU\_1+DERatioDeemed\*(1-cait)\*(ROEU\_1-ca10\_1)))%>%

 ROEL=100\*(ROEU\_1+DERatioDeemed\*(1-cait)\*(ROEU\_1-dgs10\_1)))%>%

 # Simplifiy the file by removing unused columns

 select(-company,-caseid,-rateChange,-reqRB,

 -RateChange,-RBValMethod,-Lag,-Interim,

 -Phase,-DecisionType,-RB2,-TestYrEnd,-uscitr)

# Create annualized Electric data by year, state, and casetype.

roeUS1\_yr<-usfile2%>%

 filter(service=="Electric")%>%

 group\_by(yr=yrAuth,state,CaseType)%>%

 summarise(ROEA\_US=mean(AuthROE,na.rm=TRUE),

 ROEAdj=mean(ROEL,na.rm=TRUE),

 DE=mean(DERatio,na.rm=TRUE))%>%

 ungroup()%>%

 mutate(state\_case=paste(state,CaseType,sep="\_"))%>%

 pivot\_longer(cols="ROEA\_US",values\_to="ROE")%>%

 select(-name)

# Ontario awarded ROEs grouped by year

roeCA\_yr<-cafile%>%

 group\_by(yr)%>%

 summarise(ROE=100\*mean(ROE,na.rm=TRUE))%>%

 ungroup()%>%

 mutate(state\_case="Ontario\_Dist",

 CaseType="Distribution",

 state="Ontario",

 ROEAdj=ROE)

roeCA\_yr<-roeCA\_yr[,c(1,5,4,6,3,2)]

roeCA\_yr<-roeCA\_yr%>%

 mutate(DE=1.5)

# Combine roe files.

# This file is all US states + ontario by year and case type.

roe1\_yr<-rbind(roeUS1\_yr,roeCA\_yr)

# This file is the same as above except that it is \*only\* for

# the comps: NY, MA, CA, Ontario

roe\_yr\_comps<-roe1\_yr%>%

 filter(state %in% c("NY","MA","CA","Ontario"))

# Save the two files in .csv format for excel

#write\_csv(roe1\_yr,file=paste(csvDir,"snl\_states\_yr.csv",sep="/"))

#write\_csv(roe\_yr\_comps,file=paste(csvDir,"snl\_comps.csv",sep="/"))

# Plot the 50 State & CA electric ROE data adjusted for leverage & taxes

plotData<-roe1\_yr%>%

 filter(state %in% c("Ontario","NY","CA","MA"))

 ggplot()+

 geom\_line(data=roe1\_yr,aes(x=yr,y=ROEAdj,group=state),colour="grey34",alpha=.5)+

 geom\_line(data=plotData,aes(x=yr,y=ROEAdj,group=state,colour=state),

 linewidth=1.25)+

 ylab("Percent")+

 xlab("")+

 theme\_bw()+

 scale\_color\_manual(values=colPalette,labels=c("California","Massachusetts",

 "New York",

 "Ontario"))+

 scale\_y\_continuous(labels = function(x) format(x, nsmall = 1),

 limits=c(0,14))+

 # geom\_segment(aes(x=2023, xend=2024, y=8.9,yend=8.9),colour="grey34",

 # linewidth=1.5) +

 geom\_point(aes(x=2024, y=8.95),colour=colPalette[5],

 size=3,shape=15) +

 #Alberta

 #geom\_point(aes(x=2024,y=9.91),colour=colPalette[6],size=3,shape=15)+

 geom\_point(aes(x=2024,y=9.43),colour=colPalette[6],size=3,shape=15)+

 #BC

 #geom\_point(aes(x=2024,y=10.31),colour=colPalette[7],size=3,shape=15)+

 geom\_point(aes(x=2024,y=10.28),colour=colPalette[7],size=3,shape=15)+

 geom\_point(aes(x=2017,y=2.5),color=colPalette[5],shape=15,size=2)+

 annotate(geom="text",label="LEI as submitted",x=2018.75,y=2.50,

 size=3.5)+

 geom\_point(aes(x=2017,y=2.0),color=colPalette[6],shape=15,size=2)+

 annotate(geom="text",label="Alberta 2024 Re-levered",x=2019.175,y=2.0,

 size=3.5)+

 geom\_point(aes(x=2017,y=1.5),color=colPalette[7],shape=15,size=2)+

 annotate(geom="text",label="British Columbia 2024 Re-levered",x=2019.75,y=1.5,

 size=3.5)+

# ggtitle(label="Authorized Equity Returns: US, Selected US States, Ontario

# Adjusted for Leverage & Taxes")+

 theme(plot.title=element\_text(hjust=.5,face="bold",colour="grey34"),

 legend.position="bottom",

 legend.title=element\_blank())

 #axis.text.x=element\_blank(),

# axis.title.y=element\_text(colour="grey34"))

# Data to export for Excel

#roe1\_yr\_wide<-roe1\_yr%>%

# filter(state %in% c("CA","MA","NY","Ontario"))%>%

# pivot\_wider(names\_from="state",values\_from="ROEAdj",id\_cols="yr")

#write\_csv(roe1\_yr\_wide,file=paste(rawDir,"ny\_ma\_AdjROE.csv"))

# Analysis of data since 2020. Response to Interrogatory M3-10-OEB Staff-42

 roe\_2021<-roe1\_yr%>%

 filter(yr>=2020)%>%

 filter(ROEAdj>=11.08)%>%

 group\_by(state)%>%

 summarize(N=n(),

 avgAuth=mean(ROEAdj,na.rm=TRUE))

# Table of ROEAdj for (1) All US (avg); (2) CA,NY,MA; (3) ontario

# average by year.

us\_by\_yr<-roe1\_yr%>%

 filter(state!="Ontario")%>%

 group\_by(yr)%>%

 summarise(avgROEUS=mean(ROEAdj,na.rm=TRUE))

ca\_by\_yr<-roe1\_yr%>%

 filter(state=="Ontario")%>%

 group\_by(yr)%>%

 summarise(avgROECA=mean(ROEAdj,na.rm=TRUE))

comps\_by\_yr<-roe1\_yr%>%

 filter(state %in% c("NY","MA","CA"))%>%

 select(yr,state,ROEAdj)%>%

 pivot\_wider(id\_cols=yr,names\_from="state",values\_from="ROEAdj")

avgROE<-us\_by\_yr%>%

 left\_join(comps\_by\_yr,by="yr")%>%

 left\_join(ca\_by\_yr,by="yr")

#write\_csv(avgROE,file=paste(rawDir,"avgROEAdj.csv",sep="/"))